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Suppression of Sparking.

ABSTRACT FROM A LECTURE BY PROFESSOR SYLVANUS P. THOMPSON.

There are some half dozen different ways of trying to get rid of the sparking that occurs in the breaking of an electric circuit whenever there are electro-magnets in that circuit. Many attempts have been made to try and get rid of this evil. For instance, one inventor employs an air blast to blow out the spark just at the moment it occurs. Another causes the spark to occur under a liquid. Another wipes it out with a brush of asbestos cloth that comes immediately behind the wire and rubs out the spark. Another puts on a condenser to try and store up the energy. Another tries to put on a long thin wire or a high resistance of liquid, or something of that kind, to provide an alternate path for the spark, instead of jumping across the air and burning the contacts. There exists some half-score, at any rate, of that kind of device. But there are other devices that I thought it worth while to examine and experiment upon, because they depend merely upon the mode of construction adopted in the building of the electro-magnet, and they have each their own qualities. I have here five straight electro-magnets, all wound on bobbins the same size, for which we shall use the same iron core and the same current for all. They are all made, not only with bobbins of the same size, but their coils consist as nearly as possible of the same weight of wire. The first one is wound in the ordinary way; the second one has a sheath of copper wound round the interior of the bobbin before any wire is put on. This was a device, I believe, of the late Mr. C. F. Varley, and is also used in the field magnets of Brush dynamos. The function of the copper sheath is to allow induced currents to occur, which will retard the fall of magnetism, and damp down the tendency to spark. The third one is an attempt to carry out that principle still further.

This is due to an American of the name of Paine, and has been revived of late years by Dr. Aron, of Berlin. After winding each layer of the coil, a sheet of metal foil is interposed so as to kill the induction from layer to layer. The fourth one is the best device hitherto used, namely, that of differential winding, having two coils connected so that the current goes opposite ways. When equal currents flow in both circuits there is no magnetism. If you break the circuit of either of the two wires the core at once becomes magnetized. You get magnetism on breaking, you destroy magnetism on making the circuit; it is just the inverse case to that of the ordinary electro-magnet. There the spark occurs when magnetism disappears; but here, since the magnetism disappears when you make the circuit, you do not get any spark at make, because the circuit is already made. You do not get any at break, because at break there is no magnetism. The fifth and last of these electro-magnets is wound according to a plan devised by Mr. Langdon-Davies, the bobbin being wound with a number of a separate coils in parallel with one another, each layer being a separate wire, the separate ends of all the layers being finally joined up. In this case there are 15 separate circuits; the time-constants of them are different, because, owing to the fact that these coils are of different diameters, the co-efficient of self-induction of the outer layers is rather less, and their resistance, because of the larger size, rather greater than those of the inner layers. The result is that instead of the extra currents running out all at the same time, it runs out at different times for these 15 coils. The total electro-motive force of self-induction never rises high, and it is unable to jump a large air-gap, or give the same bright spark as the ordinary electro-magnet would give. We will now experiment with these coils. The differential winding gives absolutely no spark at all, and second in merit comes No. 5, with the multiple wire winding. Third in merit comes the coil with intervening layers of foil. The fourth is that with copper sheath. Last of all, the electro-magnet with ordinary winding.

Electric Light in the White House.

In installing the electric light says the Washington *Star*, an effort has been made to harmonize the fixtures with the decorations of the various rooms, and care has been taken to avoid imitating any public plans. The beautiful crystal chandeliers in the east room and in the corridor have been preserved, keeping the external gas jets intact, while the interior of the copious reflectors contains a cluster of electrical lamps. In addittion to these there are 12 "suns" in the ceiling, each containing 12 lamps, which are ornamented in the colonial style of the room, besides having the Baccaret crystals to correspond with the center chandeliers. The 144 gas jets thus give place to 226 electric incandescent lamps of 20 candle-power each, producing an illumination equal to 4,280 candles.

In the green-room the original gasolier has been utilized by placing on it 14 electric lamps, which has been so neatly done as to give the impression that it was contemplated in the original design.

In the blue-room, which has been newly decorated at great expense, new side brackets were designed to match the plan of the room and the center gasolier wired for lighting similar to the one in the green-room.

The old gasolier has been removed from the red-room and four "drop fixtures"—one near each corner—and two wall brackets, which seems to be a new departure in interior lighting. The effect is most pleasing. The silk-covered wires enter the room at the center of the ceiling and are hung in graceful curves from the center to the fixtures. This arrangement will, in the near future, be changed to concealed wiring, as the room is to be redecorated in the Spring.

In the private dining-room there is a beautiful center electrolier and four wall brackets, carrying in all 13 lamps. The red-room and the private dining-room will be the only rooms depending entirely on electricity for light.

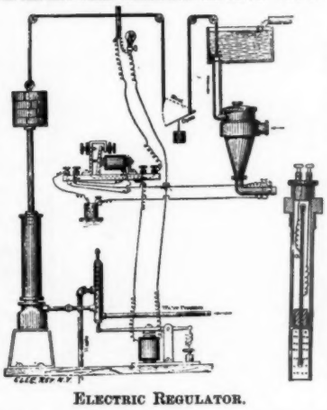
The beautiful crystal chandeliers in the corridors are being wired into combination fixtures, like those in the east room, and where certain glass poigniards once stood there now appear the white incandescent Edison lamps.

The wiring, except in the red-room, is all concealed and the daintiest of little switches appear under the edge of draperies or on like ornaments on the moldings. The basement and the entire second story have yet to be done, and some additional parts of the east room, now being made in Europe, will be necessary to complete the first story. The superintendent of public buildings and grounds, Col. O. H. Ernst of the United States engineers, assisted by Mr. G. W. Baird of the engineer corps of the navy, has the work in hand, and it is believed that when they have finished the White House will be the most beautifully lighted house in the country.

Electrically Regulating Injection of Water to Vapor Condensers.

ABSTRACT OF A PAPER READ BEFORE THE AMERICAN SOCIETY MECHANICAL ENGINEERS, NOVEMBER 1890, BY JAMES M'BRIDE, BROOKLYN, N. Y.

In the manufacture of sugar, dye-wood extracts, and other substances where liquors of light gravity are concentrated in vacuum pans, it is common practice to use what is known as the "Dry Vacuum System," in which the condensers for condensing the vapors arising from the pans are placed about 36 feet above the surface of the water in the hot wells which seal the lower end of



ELECTRIC REGULATOR.

the "leg," or discharge pipe from the condenser.

As the quantity of steam used for evaporation is often variable, and the quantity of liquor fed to the pan also varies, it will be seen that the proportions of the two are constantly changing, and if no measures are taken to control the amount of water used for condensation to suit the constantly changing quantities of heat passing to the condenser, there must be times when *too little* and times when *too much* water is used, and the pan-man is apt to use more than is necessary, and at times to entirely forget to shut off the water when the pan is not in use, consequently increasing the cost of manufacture by the needless waste of water.

It was to obviate this waste of water, to secure a more uniform vacuum, to take the manipulation of the injection valve out of the control of the pan-man and to make the quantity of water supplied always proportionate to the quantity of heat going to the condenser that this apparatus was devised.

It consists of a mercurial thermostat placed in the discharge pipe of the condenser, in connection with an electrical circuit and relay, which, in turn, controls the main circuit, in which an electro-magnet controls the valve of a water accumulator, operating the injection valve which supplies water to the condenser. By reference to the sketches it will be seen that the local circuit is opened or closed by a rise or fall of temperature in the discharge pipe; *a rise* of temperature *closing* the local circuit, *opening* the main circuit and increasing the supply of water, and a *fall* of temperature *opening* the local circuit and *closing* the *main circuit*, diminishing the supply through the action of the accumulator.

In practice it has been found that the temperature of the hot well does not vary quite 2° Fahr., and that the device completely regulates the varying amounts of heat passing to the condenser, and that when all the steam is shut off the water is also shut off.

This regulation is accomplished by making the stroke of the accumulator quite long and the movement of the piston quite slow, so that the piston never reaches the end of its stroke in either direction before a change in temperature reverses its motion. If the steam is entirely shut off, the piston reaches the end of its stroke in *one* direction, almost, but not quite, closing the injection valve. This not quite closing the valve will leave enough water flowing to start condensation, then steam is again turned on the pan, and put the accumulator in operation. When but little steam is used the piston works back and forth near the end of the accumulator where the injection valve is nearest closed; and when more steam is used the piston works nearer the other end, where the valve is wider open, the changes occurring about once per minute. The apparatus can be worked either with a battery or a dynamo current. A single cell of gravity battery is sufficient for the thermostat or local circuit, and four to six cells of the same battery for the main circuit.

I have found no difficulty in carrying a vacuum of 26 inches with a hot well temperature of 120°, and I believe the temperature can be increased to a point limited only by the preservation of the rubber valves of the air-pump.

The thermostat is a brass tube or plug, screwed into the discharge-pipe of the condenser, and having in its lower end a rubber cork, through which extends the glass bulb containing the mercury; the bulb is surrounded by a perforated shell, allowing the water to come in direct contact with the bulb, thus making it very sensitive to changes of temperature.

It will be noticed, from the arrangement of the working parts, that the most probable contingency is provided for, viz., the accidental breaking of either electric circuit.

If the bulb of the thermostat should break, the mercury would be forced to the upper end of the tube, thus closing the local circuit and opening wide the injection valve. If the carbon of the lamp should break, or the dynamo should stop, a like result takes place; or if, instead of a dynamo, a battery be used for the main circuit, and it becomes too weak to work the accumulator valve, the result is the same, so that in any of these events a full supply of water will be turned on the condenser, thus preventing the pan from boiling over until repairs can be made.

It is apparent from the foregoing description of this apparatus, that it automatically provides for the following changes of working conditions:

First. It provides for more or less steam turned on the pan by hand.

Second. It provides for a rise or fall of boiler pressure without having to change the steam-valves on the pan.

Third. It provides for a variation of the gravities of the liquors under concentration; and

Fourth. It provides for the varying Summer and Winter temperatures of the injected water. In a word, it constantly maintains the proper proportions between the number of heat units passing to the condenser and the number of pounds of injection water to absorb these heat units up to a previously fixed temperature of the water condensation, or temperature of hot well.

A Mica Find.

A great mass of mica is said to have been discovered in the mountains of British Columbia, near the head of the Tete Jaune Pass, 40 feet wide and 50 feet high, in the exposure, which indicates that there is "a mountain of mica." The quality is said to be very fine.

Lighting of a Powder Mill by Electricity.

A recent issue of the *Bulletin International de l'Electricité* contains a description of the electric lighting of the national powder mill of St. Médard-en-Jalle. The directors had erected a small experimental plant at first, in order to test the applicability of the electric light throughout the works. The lighting being found satisfactory, MM. Sautter, Harlé & Cie were instructed to put up a complete installation, which is now in full operation. There are installed nine arc lamps of 1,500 candle-power and a number of incandescent lamps, which are protected against breakage by glass globes and wire guards. Owing to the various buildings being some distance from each other, it was not easy to carry out the lighting arrangements. It was necessary to install glow lamps in buildings 975 yards from the generating station, and to maintain a constant potential of 110 volts at the end of a conductor of 45 mm. square section, whilst the consumption of current might vary from zero to 120 amperes. These objects have been attained by the employment of an extra compound wound dynamo having two windings. One of these is in series and the other in shunt, and separately excited at a constant potential by an independent dynamo. The working of this machine has answered the anticipations put forward. When fully loaded, the loss in voltage at the distributing center does not exceed six volts, and the independence of the arcs has been obtained. Two relays, one having a green and the other a red lamp, are placed in the engine-room, so that any variations in the E.M.F., due to any change in the speed of the exciter, may be ascertained. The dynamo, which runs at 800 revolutions, works 18 hours out of the 24 with a variable load.

A Reform Speech that Got in Its Work all Along the Line.

A dozen people who stood chatting in a saloon at San Antonio, Texas, were treated to a most remarkable electrical phenomenon. At that time the elements had entered into a conflict, seemingly, with the electric fluid from the trolleys and telegraph wires, and blue and white flashes of flame were leaping wildly from water-spouts and door casements. Suddenly the carbons within the large globes hanging in the center of the room began that incessant clicking heard in a telegraph office, and the experienced ear of an operator, who happened to be one of the group, detected the fact that it was a veritable message being transmitted in the usual symbols. A note-book and pencil were drawn and the message, which proved to be an Associated Press dispatch, was written out. It was the description of the Reform Club banquet, and gave the speech of Cleveland in New York city. A telegraph and electric light wire coming together is supposed to have caused the phenomenon.

Electric Lighting Apparatus in Growing Demand.

According to the report of shipments made by the Westinghouse Electric and Manufacturing Company up to December 31, 1890, the company shipped 217 alternating current incandescent dynamos of a capacity aggregating 248,150 sixteen candle-power lights during that year. This makes a total of 730 alternating current incandescent light machines, with a total capacity of 720,800 sixteen candle-power lamps, which have been shipped by the company since its organization in November, 1886.

During the first year, *i. e.*, 1886, the shipments amounted to alternating current apparatus aggregating 2,400 sixteen candle-power lamps; during 1887, they were 106,200 lights; during 1888, 119,950; during 1889, 228,150, and during last year, 248,850 incandescent lights.

The figures prove the year just closed as the greatest record the company has ever made, and it also shows that the reputation of the apparatus manufactured by the Westinghouse Company is constantly increasing.

During last year the company, however, added another branch to its business, in the manufacture of electric street railway apparatus. The company did not commence to ship any motors until the first of July. Since then 211 fifteen horse-power motors have left the shops for the equipment of 40 electric railways. This makes an average shipment of over 35 motors per month.

The company also commenced the manufacture of alternating current arc lighting apparatus during the last year. The first shipment of these machines was made in January, 1890. Since that time the company has shipped 107 alternating current arc light dynamos aggregating a capacity of 5,680 2,000 candle-power lamps.

The Shallenberger alternating current meter and the converters utilized in connection with the Westinghouse system of alternating current electric lighting are now well known all over the globe. There are now over 20,000 Shallenberger meters and more than 30,000 converters in use.

During the month of December, the company received orders to increase the capacity of seven central station plants where its alternating current system is already in operation and, in addition, a number of new contracts were obtained for the installation of incandescent as well as arc light apparatus.

Among the latest orders are: An increase of 750 lights for Olean, N. Y.; 3,000 lights for St. Louis, Mo.; 1,500 lights for Keokuk, Ia.; 3,000 lights for Louisville, Ky.; 500 for Wilmerding, Pa.; 750 for Mansfield, Pa.; 750 for Albion, N. Y.; 750 for Berlin Falls, N. H.; 750 lights for Windsor Locks, Conn., and 500 for White Water, Wis.

The Adams Electric Railway Company.

A press dispatch from St. Louis, dated December 28th, reads as follows:

A legal war involving millions of dollars is to be inaugurated by the Adams Electric Railway Company this week. A meeting of stockholders of the Adams Company will be held to-morrow or Tuesday, at which the capital stock is to be increased to $2,000,000.

From a stockholder of the local company it is learned that the suits will be brought against the street railway companies using any of the electric railway systems infringing upon the Adams patents. The first of these suits will be brought in Boston. An eminent lawyer of this city, it is said, has already been engaged to prosecute the claims of the St. Louis company, and it is confidently expected that the Boston suit will sustain the claim. Should this result be reached, injunction proceedings will be instituted against all electric street railway systems in the United States.

The West End Street Railway officials were indifferent when shown the above by a reporter. Possibly the fact that the Thomson-Houston Electric Company is bound to protect the West End road from any damages for infringement of electric patents may have had something to do with this indifference of the West End's officials. But the Thomson-Houston officials also were very calm under the impending danger, according to press advices.

Messrs. Bentley & Knight, who have charge of the patent department of the Thomson-Houston Company, stated that they had received no notice of any suits on the Adams patents, and that they should not expect a lawyer of any standing to bring suit upon them.

Mr. Adams, they said, had two patents issued in 1884, covering an absurd form of motor that no one has ever used, or ever will use. He has turned up periodically with alleged companies having an enormous capital, but which have never materialized.

The Thomson-Houston Company refused a long time ago to purchase these patents, and, doubtless, every other electric company has also had the opportunity of refusing them, and Messrs. Bentley & Knight say there is absolutely nothing in the matter to cause the company any concern.

An Incident of the Wires.

A dispatch from Kansas City, Mo., to the St. Louis *Republic* tells this story: About noon to-day a message was received over the Associated Press wires of a disastrous fire at Rochester, N. Y., in which a Mrs. John Dietrich and her three children were burned to death. At the time of receiving the message, Harry Clark, one of the Associated Press operators at Denver, was receiving the report. At the mention of the names he threw open his key and sent the following startling message over the circuit: "That is my wife's sister; wait a minute until I can send her word."

Detroit Electrical Works.

On this page we present a picture of the new factory of the Detroit Electrical Works, at which place the well known and popular Rae system of street railway propulsion is manufactured.

The recent growth of this department has been phenomenal, which fact will be readily appreciated by reading the following list of contracts closed, the most of which have been filled since October 1st, 1890: Galveston City Railway Company, Galveston, Texas, 20 motors and trucks and 4 generators; Aurora Street Railway, Aurora, Ill., 15 motors and trucks; West Side Street Railway, Kansas City, Mo., 6 motors and trucks and 2 generators; Rapid Transit Street Railway Company, Springfield, Mo., 11 motors and trucks and 3 generators; Nashville Street Railway and Power Company, Nashville, Tenn., 5 motors and trucks and 1 generator; Riverside Street Railway Company, Fort Worth, Texas., 4 motors and trucks and 1 generator; Calumet Street Railway Company, Chicago, 8 motors and trucks and 1 generator; East Cleveland Street Railway Company, Cleveland, Ohio, 2 motors and trucks; Joliet, Ill., Street Railway, 1 motor and truck; Rapid Transit Street Railway Company, Colorado Springs, Colo., 1 motor and truck; East Reading Street Railway, East Reading, Pa., 1 motor and truck.

FIG. 1.—VIEW OF THE EXTENSIVE NEW FACTORY OF THE DETROIT ELECTRICAL WORKS.

The following increased orders have recently been received: Galveston City Railway Company, Galveston, Texas, 10 motors and trucks; Calumet Street Railway Company, Chicago, 1 motor and truck.

Entering the immense factory, which contains upwards of 75,000 square feet of floor space, we find ourselves in the main office, which is flanked on either side by the private offices of the manager and his assistants. Directly in the rear of the main office is the show-room and packing department for the lighter goods. Going on still further, we find the machine shop and engine room. In a building separate from the main building and facing on Woodward avenue is the mounting room, where the motors are placed on the trucks, tested and the finishing touches given. This department is at present only temporary, as this work will later be carried on in a contemplated addition, which will have 13,000 square feet of space. Then the present mounting room will be used for storage.

On the upper floors are found the brass foundry, insulating wire room, winding department, etc.

One noticeable feature of this vast establishment is the entire absence of a repair shop, and the claims made by the company to the

effect that they have never had one piece of their apparatus returned for repairs means much. A novel feature of the factory is the running of the entire plant by electricity. Two boilers of 200 horse-power capacity furnish power to two Buckeye engines of 110 horse-power; these in turn drive two 40,000 watt generators. In different parts of the building are motors, with an aggregate capacity of 80 horse-power. The balance of current is used in lighting. Upwards of 500 hands are employed throughout the shops, and it has been found necessary to work this force three nights each week in order to keep pace with the orders. The best of shipping facilities will soon be at hand, as a freight depot will be erected in the near future within 200 feet of the factory.

The illustration, on this page, Fig. 2, from a photograph taken by our special artist, shows the manner in which the motors are mounted on the trucks. It will be noticed that a single motor is used, the armature being geared to both axles. The fields and poles of the motor are of solid, forged wrought iron, and the end yokes of cast iron. Brass arms, extending from the sides of the motor, support the armature. The speed of the armature is below 900 revolutions at full load. The motor is 30 horse-power and the 16 foot car has a six foot wheel base.

The truck frame is built of channel iron bars and is carefully and truly jointed. The motor is attached rigidly to the frame. The motor is insulated, being supported on the sides by oak pieces. Raw hide or leatheroid pinions are employed.

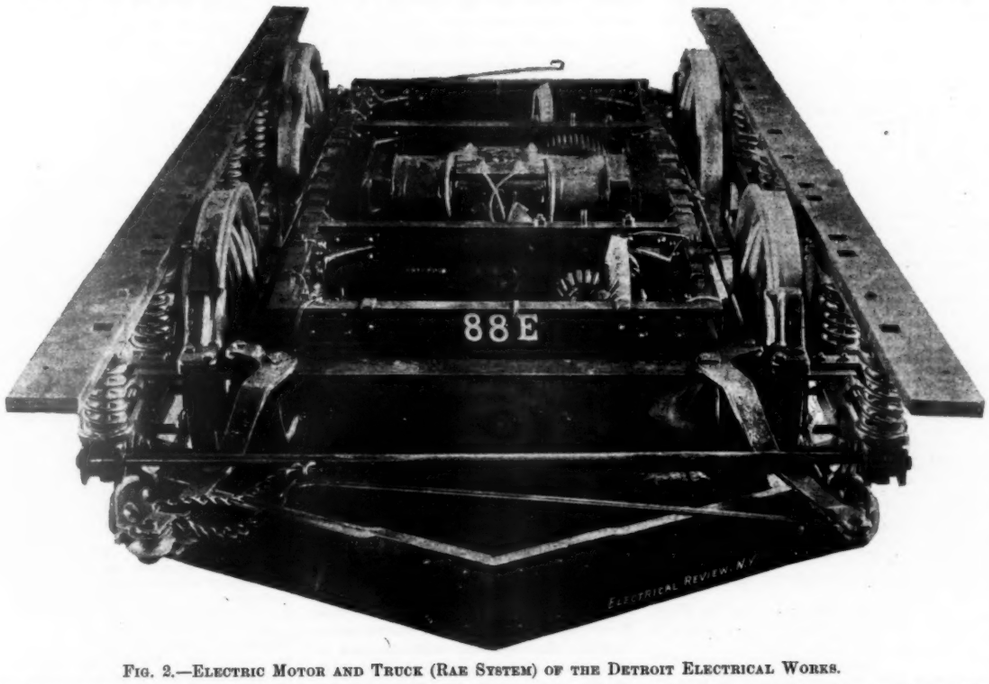


FIG. 2.—ELECTRIC MOTOR AND TRUCK (RAE SYSTEM) OF THE DETROIT ELECTRICAL WORKS.

Baxter Motor Trial.

The Baxter Electric Motor Company gave an exhibition test of their street railway system at their factory at Baltimore, December 27th. A large gathering of electricians and prominent business men witnessed the trials which proved very successful.

Intermediate gearing is dispensed with in this system, the armature being geared direct to the car axle. This gearing runs in a closed box filled with oil giving perfect lubrication and practically no noise. The armature is 18 inches in diameter, and makes about 325 revolutions per minute for a car speed of eight miles per hour. The motor is multipolar and series wound, using a special method of connecting the armature coils, an invention of Mr. Baxter's. The brushes are both on top of the commutator, in full view and easily accessible.

The motors weigh about 1,500 pounds each, which is considerably below the weight of the average railway motor. A single crank shaft, through the medium of a rheostat, governs the motion of the car.

A track on the grounds of the company was used for the tests. This track was about an eighth of a mile long, with curves of 35 feet radius and had a three per cent. grade over a portion of its length. Notwithstanding the fact that the track was covered with snow, the motors drove the car up to its maximum speed while carrying a full complement of passengers.

The officers of the Baxter Electric Motor Company, who entertained their guests at lunch in royal fashion, are: E. C. Hight, president; R. B. Griffin, secretary and treasurer; D. E. Evans, superintendent; and William Baxter, Jr., the inventor of the system.

Electrical Men and Their Part in the World's Fair.

Director-General Davis is debating with himself as to the advisability of inaugurating the electrical bureau of the world's fair, at the opening of the new year, says the Chicago *Post*. He is disposed, off-hand, to think it unnecessary to appoint a chief for the bureau at the present time, but to depend rather upon the department of installation to do what is desirable in the way of awakening the interest of home and foreign electricians for the next year or 18 months. At the end of that time he proposes to appoint a superintendent of electricity, and to promote the business of getting up an exhibit by any method agreed upon by the electricians. "But," said the director-general to a reporter for the *Evening Post*, "if the electricians want the appointment made and will give me any good reason why it should be made now rather than a year hence, I shall feel like inaugurating the bureau at once and appoint the electrician."

The general sentiment among electrical people, we believe, is that a head to this important department should be appointed as early as possible and work promptly begun.

Storage Batteries.

An easy rule to remember and one which we venture to recommend to every student is that given by the London *Electrician*: The Positive plate of a secondary battery is properly so called because it is Per-oxidized and Plum-colored; the Negative plate, on the other hand, is of a Neutral color, and is Not oxidized.

Brooklyn Institute.

Mr. Robert S. Dobbie, of the Edison General Electric Company, addressed the members of the department of electricity, of the Brooklyn Institute, one night recently, on "Arc Lighting," in the lecture room of the Young Men's Christian Association Building. Considering the stormy weather, the size of the audience spoke well for the interest taken in the subject by the members.

BOOK NOTICES.

"Report of Committee Upon Coke Iron Manufactures for the City of Marquette, Mich.," has been received.

The first instalment of the selections from Talleyrand's long expected Memoirs is the most striking feature of the January *Century*. A sketch of Tallyrand by Minister Whitelaw Reid prefaces this instalment.

We have received a prospectus and sample pages of Funk & Wagnalls' "Standard Dictionary of the English Language." It will be issued in a few months and will contain 175,000 words, many more than may be found in any single volume dictionary. The book will contain 2,100 pages, each page slightly larger than a page of the unabridged Worcester or Webster. Nearly 4,000 specially engraved illustrations will be used.

A large number of well known gentlemen skilled in such matters have been retained as editors, and they are striving for simplicity, accuracy and comprehensiveness.

We note from the sample pages that the etymology of a word follows the definition. This seems desirable, as the definition is usually the first thing one wants to know. The first definition of a word is that now most generally accepted; then come the meanings less generally accepted, and last, the obsolescent and obsolete meanings. To our practical mind, this seems to be the order of common sense.

Quotations given are all located and verified, and in quoting preference is given to an American author. In the pronunciation of words, the scientific alphabet is used. This is a phonetic system of pronunciation adopted and recommended by the American Philological Association, the highest authority on the science of language in this country.

One notable and extremely excellent feature of the extensive appendix will be a department called "Faulty Pronunciation and Faulty Diction," where thousands of examples of incorrect current speaking will be given. The technical terms used in different trades will be grouped.

It is not usual for the reviewer to express any opinion of a work in advance of its publication, but in this instance we feel justified in saying, in view of the information at our command, that this publication will be a distinct step forward in the art of dictionary making. It is common sense, American, progressive; as champions of progress, we shall be glad to welcome the "Standard Dictionary of the English Language."

Philadelphia.—The Schuylkill Lighting Company; capital, $50,000.

Philadelphia.—The Delaware Lighting Company; capital, $50,000.

Farmville, Va.—The Electric Heat and Power Company; capital, $100,000.

Chicago, Ill.—H. Phillips Company, to manufacture gas and electric fixtures; capital, $5,000. Incorporators: D. H. Robbin, E. F. Abbott and George S. Baker.

Milwaukee, Wis.—The Milwaukee Street Railway Company; capital, $5,000,000. For the purpose of manufacturing, purchasing and constructing electrical machinery.

Mullan, Idaho.—The Mullan Electric Light and Power Company; capital, $10,000. Directors, A. M. Strode, T. S. Hagan, Wm. Doxon, H. J. Rice, A. L. Lehman and W. T. McCaskey.

Chicago, Ill.—Chicago Battery and Traction Company; capital, $300,000; to manufacture electrical machinery and appliances; incorporators, Frank G. Holton, H. R. Durkee, Edward Atfield.

Wallace, Idaho.—The Idaho Electric Light and Power Company; with $500,000 capital. The directors are: Charles W. O'Neil, Frank C. Loring, Fred. E. Lucas, Charles A. Wing and Ely P. Spaulding.

Chicago, Ill.—Burnap Automatic Telephone Exchange Company, to own and control the Burnap automatic telephone exchange patents, etc.; capital, $1,000,000. Incorporators, Charles E. Burnap, Alfred W. Brewerton and C. F. Congleton.

Kingman, Mass.—The Kingman Water and Light Company, of Kingman; capital stock, $100,000. Directors, Frank Vincent, John F. Vincent, Hutchinson; John W. Hood, Clay Center; Robert G. Brodie, Emporia; Vernon C. Jarboe, Kansas City, Mo.

Danville, Ill.—The street car, electric light and gas companies have been consolidated, and will hereafter be known as the Danville Gas, Electric Light and Street Railway Company. The incorporators are: W. P. Cannon, F. W. Penwell and A. C. Daniel. Capital, $400,000.

Jersey City, N. J.—Empressa del Alumbrado Electrico di Cartegnia y Barrouquila is the name of a corporation with an office in Jersey City, which proposes to do business in South America in erecting and operating electric light plants, and sell and operate dynamos, meters, telegraph and telephone apparatus.

Salamanca, N. Y.—The Salamanca Electric Railway Company; capital, $100,000. directors: Hudson Anslee, T. A. Heller, Edward B. Vreeland, A. H. Kreiger, J. G. Fitts, A. W. Ferrin, W. T. Fish, H. O. Wait, R. J. McKay, of Salamanca; D. H. Patterson, of Great Valley; E. C. Somborger, of Buffalo, and F. S. Oaks, of Cattaraugus.

A Locomotive That Was Good for Something Once.

TO THE EDITOR OF ELECTRICAL REVIEW:

With further reference to your article two weeks ago, relating to the use at Schenectady of a locomotive for supplying steam temporarily, I should like to add that after the disastrous boiler explosion at the West Chester, Pa., Edison Electric Light Company's works, they used for some time the "Shaw" locomotive which was side-tracked at their works.

I guess this is the only thing the Shaw locomotive was ever good for.

Truly, W. A. STADELMAN.

Bala, Pa., Dec. 29th, 1890.

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NEW YORK, JAN. 10, 1891.

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Doesn't it seem a little odd that the White House, the royal palace of this republic, is just getting electrically lighted?

The motor man is unquestionably in favor of vestibuled electric cars. They protect him from heat in summer and cold in winter.

Our prediction is that the reaction in financial circles will be productive of one of the best years the electrical industry has ever enjoyed.

A short time since Council Bluffs was beautifully worked by two primary-storage-$10-light-of-the-world-battery fakirs. Some prominent business men got stock and stuck, and the fakirs got $500 and arrested. Westward the course of battery fiends takes its way, and some day they will strike the coast and get dumped overboard into the Pacific.

Two decisions of the Treasury Department, referred to in another place, present a curious case. Electricity, the department holds, can be imported free of duty, while natural gas is subject to a duty of 10 per cent. *ad valorem*. What is to prevent the importers of natural gas from using it under boilers outside the United States borders, making steam, driving engines, working generators and importing their gas power free of duty as an electric current? A few miles of wire only is needed.

Since January 1, the *Elektricitäts Zeiting*, of Berlin, is published daily. This is a distinct advance in electrical journalism and we hope it will succeed.

The death of the old and the birth of the new year were masked by a fog which spread itself over the whole country. It was the thickest and most extensive known for years. The telegraph service suffered badly through leaks and grounds, for the fog was very wet. The press associations sent only important news in brief form, the typewriting telegraphers receiving at about one-third their usual rate.

The year we have just entered upon will be one of wonderful progress in the electrical field. This is not only our opinion, but that of the thinking men of the profession. It will be the aim of the publishers and editors of the ELECTRICAL REVIEW to keep in perfect touch with whatever developments the lapse of time and the exercise of ability bring forth. We will be your bright mirror and try to reflect toward you whatever occurs outside the angle of your direct vision.

Electrical Enterprise is the latest star to rise in the firmament of electrical journalism. It proposes to rise from Boston weekly, and shed the effulgence of its rays over a broad field including "electricity and kindred interests." John G. Lynch, who, if our memory is not treacherous, is an old Providence *Journal* man, is editor; Frank M. Gilley, at one time a correspondent of and contributor to the ELECTRICAL REVIEW, is associate editor; and Albert P. Bicknell, is business manager. Success to the new *Enterprise*.

Says the Boston *Globe*: "A notable change in the directory of the Thomson-Houston Electric Company took place January 1, by the resignation of Mr. S. A. Barton, the organizer of the company and a member of the board since 1882. From 1882 to 1886 Mr. Barton also occupied the position of general manager and treasurer, at which time he removed to Chicago to build up a Western business. On returning in the Winter of 1889 he organized a central purchasing department for the various Thomson-Houston interests, and has recently assented to taking the presidency of the Brush Electric Company at Cleveland, O., and reorganizing the same, but will not change his residence."

COIN SWEATING BY ELECTRICITY.

In a recent issue we referred to the possible adoption of electric welding to the minting of bi-metallic coins. The idea is ingenious, and likely to prove entirely successful. It now appears, if newspaper reports may be credited, that electrical methods have already been applied to reducing the weight of coins, but for a less laudable object than that mentioned in our recent writing.

It has recently been noticed that a large number of light gold coins are in circulation, and the discovery has been made that the "sweating" is accomplished by electrolysis. The scientific swindler constructs an electro-deposition plant, using a ten dollar gold piece as an anode and a small metal plate as a cathode. The battery is "set in motion" (newspaper scientific terminology), and, presto! in a few minutes 50 cents worth of gold is deposited on the metal plate, and the gold coin is worth so much less than before.

As the gold is removed equally from all parts of the surface of the coin, its appearance is scarcely altered by the process, only an expert being able to detect the slight blurring of the design and lettering. When the coins come to be weighed, however, the result is more apparent, and cases have lately come to light where large payments made in gold have revealed light weight to the tune of several hundred dollars.

Truly, this is the age of electricity, when electrolysis is turned to account by thieves and swindlers for sweating the currency! It is to be hoped, for the vindication of science, that the same subtle agent that is at present being subverted to further such nefarious schemes will bring about the capture of the schemers.

ELECTRICAL SOCIETIES IN AMERICA.

The season of short days and long evenings is now well advanced and with it the regular sessions of the scientific societies who hold meetings during the winter months for the ventilation of subjects in which the scientific world is interested. These meetings are carefully and systematically reported in our columns as they occur, but it is not unprofitable to review the subject of electrical lectures and discussions in a general way, pointing out a few of the salient features which strike us as praiseworthy or otherwise.

In the first place, it must be a matter of pride to all American electricians to note the prominence given in technical journals the world over to the papers and discussions emanating from American electrical societies. We have long been accustomed to receive our electrical literature from the other side of the water, almost all of the text books referred to in every day work in this country being of British authorship. To-day, as in former years, many valuable contributions to current electrical literature are derived from addresses to the Royal Society, Society of Arts and the London Institution of Civil and Electrical Engineers.

American electrical societies, although of far later growth than the foreign bodies to which we have referred, have good reason to be proud of their record; among the papers read and discussed at their meetings there have been many of permanent value and interest, both as records of actual experience and work accomplished, and descriptions of original investigations in various lines of electrical development. The American Institute of Electrical Engineers, although it has been only a few years in existence has given to the world a large number of valuable papers touching upon almost every branch of the electrical industries.

The Electric Club, besides its primary mission of cementing the bonds of good-fellowship amongst electrical men, has fostered a course of lectures attended with remarkable success, and from this source also has electrical literature been benefitted to no small degree. The New York Electrical Society, although an older body than either the Institute or the Club, has, until lately, led a less active existence; but, during the past year or two a great access of energy has been experienced, the membership has been strengthened, and the Society has fairly entered upon a new era of prosperity.

With three meetings a month, electrical men need have no cause for complaint that there is not every opportunity to discuss all the burning questions of the day. In this one respect we could wish to see a little improvement—we refer to the discussions. It is very seldom that a good discussion follows a paper read before one of our societies. This is due to various causes. In some cases, such as certain of the Electric Club lectures, a long discussion is neither necessary or desirable—the subject often being complete in itself and only complimented to a limited extent by the remarks of the speakers who follow the lecturer. As a proof of this we may mention that these remarks are seldom printed.

In other cases, however, the papers brought forward are of the very nature to provoke long and interesting discussions; yet such discussions seldom take place. The principal reason is that it is next to impossible to intelligently discuss a paper that one has not had the chance of reading through carefully, but which has simply been read out by a speaker. Discussions certainly do take place, but they are by no means up to the level of the papers.

There are two ways out of the difficulty; to have the papers printed beforehand, or, if this is impossible, to postpone the discussion until the following meeting. The best mission after is to draw forth a good discussion from men who are the most conversant with the particular subject, and when this mission is not fulfilled the usefulness of the paper to subsequent readers is not nearly so great as it might and should be. The management of the technical societies should bear well in mind that the proceedings are read and studied by electricians the world over, who receive them in the technical journals, and every effort should be made to secure ample discussion of each subject so that this large outside constituency may benefit to the utmost by the experience of their more fortunate brethren who are able to provide the history of electrical development.

CORRESPONDENCE.

OUR BOSTON LETTER.

Mr. Geo. T. Manson, of New York, was detained in this city several days longer than expected, and clinched several large orders for Okonite wire and Manson tape.

Dr. A. F. Mason, general manager Simplex Electrical Company, returned to Boston from a visit to Chicago early in the week, quite sick from over-zealous attention to business. To-day his health was so much improved that he was able to visit his office.

Mr. Wm. H. McClure, recently elected city electrician of Worcester, Mass., to succeed Mr. C. M. Mills, and is also the superintendent of fire alarm of that city, was in Boston during the week, and a welcomed guest at the Boston Electric Club.

Mr. George Cutter, of Chicago, was in this city several days during the week attending to business matters connected with a new electrical enterprise he recently inaugurated in the city named. He has been appointed general western agent of the Schaefer Electric Manufacturing Company, Boston, Mass., and he will fill a similar position for the Electrical Supply Manufacturing Company, of Manchester, N. H.

Mr. Samuel E. Peck, for many years identified with electrical interests in this city, has returned from Mexico, where he has been recuperating his health. While in that country Mr. Peck represented the vast and varied interests of the Thomson-Houston Electric Company, and was ably assisted by Mr. Burgess of the same corporation, in stirring up great activity in electrical matters, particularly so in the cities of Mexico and Monterey. The large number of friends and acquaintances of Mr. Peck will be pleased to learn that he has fully recovered his health.

The Victor Electric Company is the name of a new corporation organized recently at Kittery, Me., for the purpose of manufacturing electrical apparatus. Capital stock, $100,000. President, T. H. Pray; treasurer, John Hobbs; both residents of Boston.

Steel Car Wheels manufactured by the American Steel Car Wheel Company, Boston, have been added to the equipment of 12 of the new Robinson radial truck cars recently added to the rolling stock of the West End Railway electric system. Steel wheels, especially those of the make above named, are gaining steadily in public favor, and are already extensively in use by the street railways. That steel wheels do not crack or break, and are remarkably durable, are facts which are of great importance to those who patronize street cars.

Semi-Annual Dividend of five per cent. has been declared by the H. E. Swift Manufacturing Company, payable at the office of the treasurer, No. 34 Oliver street Boston, January, 1, 1891. Business has been active and properous with the company named for several months, and notwithstanding the fact that the manufacturing facilities were considerably enlarged in October, very soon steps will be taken by this company to double its floor space, machinery and number of workmen.

The Pettingell Andrews Company has purchased the stock and good will of the supply department of Messrs. Fred M. Kimball & Company also of this city. This now enables the former to offer customers a much larger and more varied line of electric light, power and railway supplies, together with a variety of popular electrical specialties heretofore manufactured and exclusively sold by the latter. Messrs. Kimball & Company will hereafter devote their attention to the manufacture of dynamos, motors, and special electrical apparatus, repair work, and testing.

Thomson-Houston Local Interests.—A new department will be established in the offices of the Thomson-Houston Electric Company which will centralize the office business of the many separate electric lighting companies which are owned by the Thomson-Houston Electric Company. The books of the various companies will be kept and their affiairs attended to in this department. Mr. W. A. Carey will have the superintendance of it.

The American Circular Loom Company, this city, has enlarged its manufacturing facilities recently, owing to the increasing demand for its insulated wires and cables, and the numerous orders received to recover old wires and cables with the company's meritorious insulation. This company will be pleased to send to any one, a copy of its new pamphlet, which is replete with useful formulæ regarding wires and cables. Address the company, No. 620 Atlantic Avenue, Boston, Mass.

Electric Lights in Boston.—In the retiring address made by Mayor Hart of this city, before the Common Council of 1890 at its final meeting, he stated as follows:

"The lighting of the city is excellent. In two years the number of electric lights has been increased from 704 to 1,125 and their cost materially reduced. The number of gas lights has been lessened from 10,104 to 9,281, the number of oil lamps has been increased from 2,994 to 3,056. The department has been well managed."

New Electric Light Station.—Advices from Monson, under date of December, 28, state: "The electric light company's new plant is now in operation and is running smoothly. The building is of brick and is about 42x54 feet. It is equipped with a new automatic cut-off compound condensing engine, rated at 130 horse-power. The company will put in more dynamos as soon as the construction work demands it. It also intends to supply power to local industries by means of electric motors, and built the station with a view to doing this business." W. I. B.

Boston, January 3.

OUR CHICAGO LETTER.

Mr. J. L. Barclay, western manager of the railway department of the Westinghouse Electric Company, entertained a number of friends and business associates at his residence. Advantage was taken of this occasion by the employés of the Westinghouse Company in the Chicago office and former business associates to present Mr. Barclay with a very handsome scarf pin, set with a ruby and flanked on each side with a diamond.

Personal.—H. W. Underwood, general agent of the Interior Conduit Company, is among Chicago's visitors and is registered at the Auditorium.

The Property Owners in the vicinity of the power house of the West Side Electric Street Railway Company, of Milwaukee, have instituted a suit against this company, claiming that the noise and city smoke constitute a nuisance, and one of the adjoining property owners asks $20,000 damages.

At The Next Meeting of the Chicago Electric Club, which will be held on Wednesday evening, January 5, a paper, entitled "Practical Electricity," will be read by U. F. Hodson.

The Electrical Supply Company report their business as rapidly on the increase, and have recently received some very large orders, prominent among them being one for 110 miles of Shield brand insulated wire.

The Western Office of the REVIEW is in receipt of a very handsome calendar for 1891 from H. T. Paiste of Philadelphia.

Chicago, Jan. 3. D. B. D.

PERSONAL.

Mr. William H. McClure has been elected city electrician of Worcester, Mass., for 1891.

Charles D. Nash, of Whitman, Mass., has resigned his position as treasurer of the Whitman Electric Light Company.

Dwight Brown has resigned as manager of the Telephone Exchange at Hutchinson, Kan., and been succeeded by A. B. Allen.

Col. J. N. Keller, of Boston, was a welcome visitor among his New York friends this week. He reports telephone work in his city quite active.

High Pressure Alternating Mains.

Following the reading of Mr. J. Swinburne's paper on "Alternating Current Condensers," at the Physical Society, there was a discussion which drifted from the subject of the paper into a speculation on the alleged rise of E. M. F. in the Ferranti mains, says our London namesake. Prof. Ayrton stated, and he was supported by several other speakers, that the difference of potential taken from a transformer at Deptford was 80 volts, whereas, at the Grosvenor end it measured 100 volts. This enormous rise seemed inexplicable, and various theories were advanced with a view of accounting for the possibility of such a phenomenon. Prof. Ayrton referred to a conversation he had had with Mr. Ferranti, which revealed the fact that no direct measurements were made at the termini of the mains themselves, and it has ocurred to us since that there might be an error somewhere, and it would be both instructive and interesting if the low tension transformers at both ends were transposed, viz., the Deptford one to Grosvenor, and that of the Grosvenor to Deptford, and fresh measurements made. We have an idea that the results would then turn out differently, since it is just possible that the transformers themselves may be to blame for this variation; they do not always give that which they are "calculated" to produce, and it seems hardly credible that there could be an unexpected rise of 25 per cent. entirely due to inductive effects; the dimensions of both transformers, we assume, being similar. Mr. Kapp related an interesting experience of his own, when he fruitlessly endeavored to transform 1,000 into 14,000 volts; he failed entirely in the attempt, in spite of all ordinary care with insulation, the high tension transformer breaking down in every case in a remarkably short space of time. Every day it seems to become more certain that the 100,000 volt craze is giving way, and it seems a great pity that several hundred thousand pounds should have been spent it proving that which could have been as conclusively shown with as many shillings.

Historical Telephony.

BOSTON AND PROVIDENCE EX-TERRITORIAL TELEPHONE EXCHANGE.

The Inter-State Telephone Company respectfully invite your attention to the advantages of their projected ex-territorial exchange between Boston and Providence, which, it is hoped, will commend itself to you in such a manner as to secure your subscription.

A limited number of parties in Providence and Boston, who have frequent occasion to communicate with each other, will be formed into an exchange, a subscription to which entitles any subscriber in Providence to talk with any subscriber in Boston, or, *vice versa*. A call bell, telephone and transmitter, all of the latest patterns, will be placed on the premises of each subscriber, and connected by a *metallic circuit* with central operating tables in Boston and Providence, which tables will be connected with each other, also on a *metallic circuit*.

Thus, any subscriber in one city can be quickly connected and talking with his correspondent in the other city *on a complete metallic circuit, ensuring a perfectly quiet line*, free from all sorts of induction or earth currents, with no possibility of being disturbed by the conversation of others, or of having your own conversation overheard by them. No condition of the atmosphere and no trouble short of an absolute breakage of the line can interfere with the perfect working of this system.

Each subscriber has, practically, *a private line on a metallic circuit*; the only perfect system of telephony yet devised. For obvious reasons, we shall limit subscriptions to this ex-territorial exchange to a very small number, and your attention is invited to the advisability of making an early application for its benefits.

For further information and terms of subscription, apply to C. H. BARNEY, *General Manager*, Room 27, (3d Floor) Butler Exchange, November, 1881. Providence, R. I.

The above copy of a document, nearly 10 years old, shows, that in certain quarters, where wide-awake and progressive men held the reins of management, the commercial possibilities of metallic circuit working were recognized and profited by very early in the development of telephony.

Telephony, of all the varied applications of electricity to industrial affairs, is the art in which progress has been most rapid and changes in methods of working, the most radical and varied. Ten years of telephony mark strides of vastly greater magnitude and importance, effected in construction and maintenance, than three times that period can show in telegraphic progress.

It is all the more interesting, therefore, at the present time, when the highly efficient metallic circuit system of the Long Distance Company penetrates into every town of importance in the eastern States, to note that 10 years ago there were men in the telephone business who realized the importance of metallic circuit lines for long distance work. Hard drawn copper wire had not then come into general use, even for telegraphy; the transposition of wires to reduce the effects of induction from wire to wire had not been attempted; but the metallic circuit, pure and simple, was there, and a quiet line between Boston and Providence was obtained.

At the time when this pioneer long distance service was established the American Rapid Telegraph System was in full blast, and earth currents of such strength as to render ground circuit telephone working a matter of extreme difficulty were rampant in all directions. The metallic circuit line, however, defied the earth currents and the telephone emerged triumphant from the conflict. Mr. J. J. Carty, who was, of course, implicated in this affair, as he has been in so many improvements in telephony, relates an incident which goes to show how little known was even the term, "metallic circuit," in those days. The young lady operator at Providence, worried almost to death by the (American) Rapid buzzing in her ears from the local telephones, spoke to Mr. Carty, at Boston, and surprised at the quietness of the line asked him the reason. He replied: "Oh, I have fixed it upon a metallic circuit."

"Well, I only wish you could send me one over here," was the reply of the distracted young woman.

Mr. A. J. Waring, of the Standard Underground Cable Company, Pittsburgh, passed through New York last week on his way to Paris. He is going to Europe to look after some big cable contracts in Germany and France.

Mr. Richard Felton Outcault, of New York, an artist well-known in electrical circles, received a Christmas gift November 25th, at Lancaster, Ohio. Miss Mary Jane Martin became Mrs. Outcault at that time. The REVIEW cordially extends its best wishes and congratulations.

The Edison Electric Power Plant at the Edison Machine Works, Schenectady, N. Y.

One of the most extensive plants, if not the most extensive plant in the world for distributing electric power from one building about the premises of a single manufactory, is that at the factories of the Edison General Electric Company, at Schenectady, N. Y., where 15 motors, representing an aggregate capacity of 400 horse-power, are in use. The maximum distance between any motor and the generating plant is less than 450 feet. The voltage of the motors is 125.

The dynamos in use are one of 80 kilowatt, two of 50 kilowatt, and one of 40 kilowatt capacity. The motors are of all sizes, from 7½ horse-power to 80 horse-power, the smaller motors being used in special applications to be mentioned later, and the larger ones for direct driving of the factory machinery. The large motors are divided among the different buildings as follows: One 80 horse-power and one 50 horse-power in the new machine shop, one 50 horse-power in the wire department, one 40 horse-power each in the cable shop and smithy, and one 30 horse-power motor each in the storehouse and pattern shop.

Most of the motors are required to run 12 hours per day or more and 5½ days per week, with a load generally equal to and often exceeding the rated capacity of the motor. In spite of this, it is interesting to note that the machines are running entirely without sparking and with scarcely any perceptible wear on the commutator. The motors used in its special applications are attached to jib and traveling cranes.

The electric jib crane used at the Schenectady Works is of 10 tons capacity, and is operated by a 7½ horse-power Edison motor. This motor is reversible, uses carbon brushes and is connected with the drum by one set of direct gears, one set of bevel gears and one worm gear.

The starting switch is placed in a box beneath the motor, and about four feet from the ground, and the motor can be reversed and started by a single movement of the lever handle. An ingenious automatic device prevents the drum from unwinding too much rope.

This crane is used in loading machinery onto the freight cars. The action is prompt and the crane gives good satisfaction. At the present time there are three large traveling cranes in operation in the general machine shop and new machine shop. These are each operated by a 10 horse-power Edison motor, and are used in transporting heavy castings from one part of the shop to another, and in assembling machinery. The capacity of the cranes is 10 tons each.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, January 3, 1891. New York, Boston and Washington Stock. Pittsburgh closing January 2.

NEW YORK.	
Western Union Telegraph Co	77¼
American Telegraph & Cable	86
Central and South American	*145
Mexican	*210
Commercial Cable Co	103
Postal Telegraph Cable	39
Edison General Electric Co	87
" " Deferred	
Consolidated Electric Light	
Edison Electric Illuminating Co	70
United States Electric Light	30
North American Phonograph	
BOSTON.	
Thomson-Houston Electric Co	45¾
" " " Preferred	25⅛
" " " Series C	
" " " Series D	5⅛
" " International Co	
" Welding Co	
" European Welding Co	55
Ft. Wayne Electric Co	10¼
TELEPHONE:	
American Bell	*209
Erie	46
New England	50¼
Mexican	70
Tropical American	
MISCELLANEOUS:	
Edison Phonograph Doll	1¼
WASHINGTON.	
Pennsylvania Telephone	25
Chesapeake and Potomac	64
American Graphophone	12¾
United States Electric Light (Wash'ton)	*135
Eckington and Soldiers' Home Electric Railway	58
Georgetown and Tennallytown	48
PITTSBURGH.	
Westinghouse Electric Mfg. Co	13¼

* Ex. Div.

Telephonic News

*** The Cumberland Telephone Company has been granted right of way for poles and wires over the streets and alleys of Mt. Vernon, Ind.

*** The telephone company at Erie, Pa., claims that the electric railway at that place has interfered with the telephone service to the extent of $50,000.

*** The building of a telephone line from Gilroy to San Jose, Cal., will commence soon, sufficient inducements having been offered the promoters of the enterprise.

*** The Theatrophone Company now have instruments connected with the Opera Comique, Paris. The principal clubs and cafés will soon be connected and offer their patrons the latest attractions at this theatre.

*** The statement of the output of telephones by the American Bell Company, for the month and year ended December 20th, is as follows:

December.	1890.	1889.	
Gross output.....	5,542	5,010	Inc., 532
Returned.....	3,171	2,140	Inc., 1,031
Net output.....	2,371	2,870	Dec., 499
Jan. 2 to Dec. 20.			
Gross output.....	64,647	57,167	Inc., 7,480
Returned.....	27,878	24,067	Inc., 2,911
Net output.....	36,769	32,200	Inc., 4,569

*** The Houston, Texas, council has adopted the ordinance extending the franchise of the Southwestern Telegraph and Telephone Company for two years, on third reading, with amendment that free telephones be placed in the office of the mayor, the residences of the city marshal and the chief of the fire department, the police station and each of the fire companies, the poles to be painted, and a few other things which cost money but are of no importance.

*** Mr. Miles, superintendent of the District of Columbia telegraph and telephone service has sent to the Commissioners a communication strongly recommending that the wires be put underground, under the plan he submitted in 1888. He estimates the cost at $200,000. The cost of burying the wires of the trunk line from headquarters to and through Georgetown he estimates at $50,000. Superintendent Miles says that if immediate provision for burying the wires is not made an extra appropriation of $10,000 will be needed for reconstructing the overhead lines.

We Doff Our Hat.

The present inclination of the electrical engineer is to promise little and perform much. This is a safe policy for adoption in mechanics generally.—*New York* ELECTRICAL REVIEW.

Clear reasoning, sound principled, honest minded. No wonder the REVIEW leads its field.—*New York Safety Valve.*

The Graphophone Combine.

Advices from Bridgeport, Conn., under date of December 26th, state as follows:

The works of the American Graphophone Company, in East Bridgeport, continue closed, and it is thought by those connected with the concern that a resumption of operations is extremely doubtful. It is understood that the sudden shut-down when such a large business was being done was due to negotiations entered into by the managers with the owners of a Western concern engaged in the same line of manufacture. It was found that two phonograph factories could not be run with profit in this country, and hence negotiations were entered into whereby Western owners should pay to the proprietors of the Bridgeport concern a certain bonus for every year that the factory here should remain closed. This arrangement, it is said, was quickly entered into by the managers of the American Graphophone Company, and as a result they are now drawing a neat sum every year from the Western men, without having to take the business risk and cost attendant upon running a shop. The other company is entirely satisfied with the arrangement, however, as they now really control the market.

The Institution of Electrical Engineers.

Our esteemed contemporary *Industries* (London) gives the following account of a meeting of this Institution on the 11th ult.: The discussion was continued on the papers entitled "The Working Efficiency of Secondary Cells" and "Notes on the Chemistry of Secondary Cells," by Professor W. E. Ayrton, Mr. C. G. Lamb, Mr. E. W. Smith and Mr. M. W. Woods.

Mr. S. Joyce, Jr., said, when discharged at high rates and, therefore, requiring frequent repairs, red lead paste did not stick in the positive plates. Litharge paste, similar to that used for negatives, had proved very satisfactory.

Mr. D. G. Fitzgerald, speaking of the chemical constitution of the negative (peroxide) plate, said it was generally believed that PbO_2 enters largely into its composition. There is, however, reason to doubt whether any of this compound is present, for the behavior of the active substance on the plate is quite different from that of the pure per-oxide of commerce. He believed that electrolytic per-oxide is $H_2Pb_2O_5$. As regards the best kind of support or grid for the spongy lead, he said it was a mistake to use lead, for copper is, in many cases, much better. The beneficial effect of soda in secondary cells he attributed to the formation of a double salt, which is easily reduced. Sulphate of magnesium has an extraordinary influence on lead plates, and by using a solution of it as electrolyte, he had got discharges 30 or 40 times greater than those obtainable from sulphuric acid.

Professor J. Perry asked the distinguished chemists present if the double sulphate really existed, and Professor Ayrton also inquired whether there were any simple tests by which such sulphates, if formed, could be detected.

Dr. Gladstone said Mr. Hibbert and himself had concluded that there was no evidence of double sulphates being formed in the action of secondary cells. He believed the general idea as to the influence of sodium sulphate was that lead sulphate was more soluble in the mixture than in simple acid; this, however, was not confirmed by experiment.

Mr. Crookes, the new president, said sulphuric acid had a great tendency to form double salts, and thought it very probable that such salts would be formed in the case under discussion.

Professor S. P. Thompson said that the details relating to the formation of plates, given in the second paper, were, he thought, not new, and were practically what any one having a knowledge of the properties of the substances used, and of the reactions which it was desired to bring about, would have arrived at theoretically. For example, to oxidize the positives, one would aim at producing the most powerful oxidizer in the shape of ozone, the formation of which is facilitated by strong acid, large current density and low temperature. On the other hand, to reduce the litharge on the negatives it was known that a large current density mainly produced gas, and that reduction is best effected by small current density at a fairly high temperature. Bearing in mind these opposite conditions, one readily realized that the plates should be formed separately, and that the negatives would require a much longer time. Several years ago he tried cells with electrolytes other than sulphuric acid, and found that phosphoric acid was the only one which gave fairly good results.

Professor Ayrton, referring to Dr. Gladstone's criticism about the ammonium acetate method, said that Mr. Robertson had used this method, but somehow or other the paragraph describing it had not been printed in the first proof. Speaking of measuring the resistances of cells, he pointed out that unless the curve connecting time and E. M. F. was discontinuous at the instant of breaking circuit, the method used should give correct results. So far as he knew there was no evidence of any such discontinuity. Mr. Crompton had said the resistance was practically independent of the distance of the plates apart, and that the sulphating of the negatives during rest depended greatly on light. Taking the case of resistance first, they had made experiments on a small two-plate cell, and found that when the ordinary method of testing was employed Mr. Crompton's statement seemed nearly correct, but on using the more sensitive method illustrated in Figs. 10 and 11 of the Edinburgh paper, this was not the case.

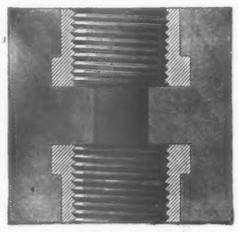
Some speakers, he said, had remarked that many of the facts brought forward in the papers were previously known. Manufacturers might have been aware of them, but, if so, they had kept them secret and never published them. For example, Dr. Gladstone was not aware of the differences in the hardness of the plugs at different parts of the plates until the appearance of their paper.

Again, Dr. Thompson said there was nothing new in the methods of forming the plates, whereas Mr. King apparently did not know of them. Mr. Swinburne had also called their attention to a prediction of the cooling of cells during discharge made in 1887, but at that time he admitted that he had not observed it. Speaking of the efficiency of cells, he said some people thought the very perfect testing apparatus gave their high efficiency; this, of course, was not true, for their figures merely express the results obtained when cells are used in a proper manner.

Referring to a criticism on the Edinburgh paper, which appeared in one of the leading technical papers of July 25th, he said the writer had only partly understood the early part of the paper, for they (the authors) had there explained that one of the objects of the investigation was to see what error could be made by neglecting the previous history and the resuscitating power of cells. The same writer had also stated that the results of laboratory tests were not applicable to ordinary working conditions. Here again he had fallen into error, for a secondary cell is a thing complete in itself, and if two or three selected at random give good results under proper treatment, so any number, if similarly treated, will show equal efficiency.

The Erickson Insulating Coupling.

An insulating device for coupling combination gas and electric light fixtures, is shown in the illustrations on this page. The Erickson coupling is made of a very strong insulating material in the form of a hexagonal nut, with threaded brass bushings,



of any required size, cast in each end. It is all in one piece, and there being no auxiliary parts of any kind, there is no chance of grounding the current or leaking of gas.

The insulating compound is unaffected by gas, and the simplicity of the device leaves nothing to get out of order. The coupling being in one piece, is easily and quickly connected to the piping with an ordinary wrench. Its great strength makes

it especially adaptable to heavy chandeliers. The Eastern Electrical Supply and Construction Company, 65 Oliver street, Boston, are sole agents for this device in the United States.

They Believe in Electric Railways.

That distinguished New Haven scientist who proclaimed with such certainty that electric cars are always powerless in a snow storm should have been in Ansonia yesterday. The snow was the meanest sort for the cars. It would not pack, but its dry, sand-like quality hindered more than a deeper and damper snow. Yet the cars ran all day and evening and omitted but few trips. New Haven's horse cars, on the contrary, were blocked, and worn out, winded horses were tired to death when released from their burdens.—*Ansonia, Conn., Sentinel.*

Again in Favor of Brush.

An important decision, by Judge Henry B. Brown, of Detroit, who has just been appointed associate judge of the Supreme Court, was filed in the United States Circuit Court, at Cleveland, Monday, December 29th. Judge Brown heard the evidence while occupying the bench during the illness of Judge Howell E. Jackson. The case was that of the Electrical Accumulator Company, of New York, against the Brush Electric Company, of Cleveland, and the decision is upon the request of the Accumulator Company to dismiss a suit against the Brush Company, and upon the demurrer made by the Brush people to amended and supplemental bills of the Accumulator Company. Camille A. Faure was granted a patent in this country on a unique secondary battery January 3d, 1882, and in a month or two afterwards a patent was granted on almost exactly the same invention to the Brush Company. The Faure patent passed to the possession of the Electrical Accumulator Company, of New York, and this company began a suit against the Brush Company to procure an adjudication of the invalidity of the Brush patent.

A demurrer and answer were filed by the Brush Company affirming the validity of its own patent and denying the validity of the Faure patent. The Accumulator Company proceeded to take *prima facie* proofs and the Brush Company to take its answering proofs. Then the Accumulator Company filed a supplemental bill setting forth that the first claim of the Faure patent had been adjudged to be valid in the Circuit Court of the Southern District of New York. The supplemental bill alleged that since the filing of the disclaimer, the Faure and the Brush patents had not been interfering within the meaning of the law, and asked the court to dismiss the case.

The Brush Company, however, objected to having it dismissed, and denied that the two patents were not interfering. This raised the question as to the right of a plaintiff to dismiss a case after proofs have been taken and before the hearing, and after an answer praying for affirmative relief has been made.

After citing many decisions, Judge Brown said he had come to the conclusion that leave to dismiss a bill should not be granted where the action would be manifestly prejudicial to the defendant. In this case litigation has been pending for three years, and the Brush Company is entitled to a decree, declaring the invalidity of the Faure patent, provided it can establish the priority of its own patent. The petition to dismiss the case was, therefore, denied.

Uses of Electricity in Office Work.

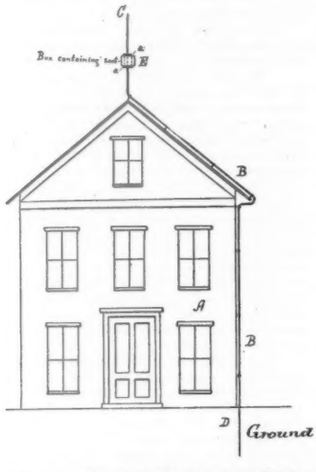
The introduction of electric light plants into railway offices furnishes a supply of electricity which has been successfully used in many cases for running small motors for expediting and improving certain classes of office work. We were recently interested in the manner that the current from the ordinary lamp wires was utilized in the passenger department of one of our railways. The changing of the style of ticket forms used necessitated the "killing" of a large supply of antiquated coupon tickets. This was formerly effected by means of a small punch worked by hand-power, the machine having a fly wheel to equalize its motion, the hole punched being about half an inch in diameter. The stock of tickets requiring cancellation being large, the turning of the wheel was a tedious job, necessitating the labor of two clerks, one to turn the wheel and one to feed the tickets. This being found expensive, a small motor was connected with the punch, taking its current from the wires of a 16 candle-power incandescent lamp. The result was an increase in speed at which the work was done and a saving in time of those employed, as the service of the clerk who formerly turned the crank could be made available elsewhere. The same motor when not in use for cancelling tickets was used to run a small ventilating fan which served to improve the air in the ticket vault.

In another part of the same office these cancelled unused tickets as well as the used ones are cut into shreds by revolving circular knives before being sold for old paper. This machine formerly required the constant work of one man at the crank but this service is now performed with an improvement as to average work done by the use of another similar motor. Doubtless, other adaptations of this power to railroad office work have been and will be adopted, but the foregoing will serve to indicate the largeness of the field thus opened.—*Railway Review.*

Protecting Buildings from Lightning.

To the Editor of Electrical Review:

Dear Sir—Enclosed is a copy of the specifications of my patent, No. 443,048, for a new method of protecting buildings from lightning, to which I would respectfully call your attention, as I believe the patent contains the germ of a more or less important advance. The starting point, historically, of the invention was the re-reading of the theory generally given in explanation of the formation of the high potential exhibited in lightning discharges. The basis of all the theories that have been suggested to explain this high potential is, that, having a given quantity of electricity on the surface of a



given quantity of matter in a finely divided state, the potential of the charge will be increased if the particles of matter coalesce into larger particles, thereby reducing their aggregate electrical capacity.

It struck me that if this theory were true, it ought to be possible to receive a lightning discharge on some large body, which would then break into particles whose aggregate electrical capacity would be considerable, and the potential of any charge received on the large body would thus be materially reduced.

The first book that was at hand in which to look up the records of actual lightning strokes happened to be Sir William Thomson's "Papers on Electricity and Magnetism," and I found that he records one case of lightning discharge somewhere in Scotland, if my memory does not deceive me, and that in this record the actual phenomenon on which my invention is based—the dissipation, in fine powder or vapor, of the body upon which the electrical action manifests itself—is clearly stated. Of course, as you well know, this shattering action of lightning discharges is a most frequent phenomenon, but, so far as I know, it has not been put to use. The well-known phenomenon of lightning discharges following smoke and steam merely indicates, as it seems to me, that by following them the electric charge finds a path along which its potential is reduced.

There is another way of looking at the same thing, which considers the electrical energy present in the column of dielectric from the cloud to the earth just before the discharge. This electrical energy has got to be transferred into some other form. An ordinary lightning rod of good conductivity, and which withstands the shock, offers no *locus*, if I may call it such, in which the dissipation of energy may take place.

I contemplate the use of a rod of such character as is known to be easily destroyed by a lightning discharge. In fact, it seems to me that the attempt to save both house and rod has been a mistake, and that if we give the discharge a rod to destroy, we can save the house. The quantity of rod which has been dissipated in any discharge does not exceed a few cubic inches, and I have yet to find a case where the destruction of the rod has not at least mitigated the effects on the house.

I appreciate that this is not in accordance with the rules generally given for the construction of lightning rods, but fairly diligent search of actual records leads me to think that if we spare the rod we shall spoil the house. Yours truly,

N. D. C. Hodges,
Editor of *Science*.

New York, Dec. 29th, 1890.

Another Step Forward.

In the physical laboratory of Colby University, on December 31, 1890, Prof. Edward A. W. Morley, of Adelbert College, Cleveland, and Prof. William A. Rogers, of Colby University, succeeded in measuring, by means of the wave lengths of light, the changes in the length of bars of metal caused by variations of temperature. A machine constructed by Professor Rogers for the special purpose was employed, and changes in length were measured in millionths of an inch.

Treasury Department Decisions.

Recently a clerk of customs of one of the ports of the Texas border made inquiries of the Treasury Department as to the tax which should be assessed against a certain electric company which was wiring across the Rio Grande into American territory.

Secretary Spaulding decided that inasmuch as electricity is intangible and, as he puts it, cannot be measured, electricity might come in free.

About the same time Clerk Morgan, of Buffalo, inquired how he should treat the importation of a certain company in Buffalo who had made arrangements to bring natural gas across the Niagara river from Canada into the United States through the medium of an eight-inch pipe.

In this case the Treasury Department prepared a decision which the assistant secretary signed, in which he holds that natural gas is an unmanufactured product not otherwise provided for, and is, therefore, dutiable at the rate of 10 per cent. *ad valorem*.

The Way They Store Electricity in Maine.

One of the yarns of the season comes from Cherryfield, says the Lewiston, Me., *Journal*. Its hero is "Uncle Sile Leatherbee," described as a farmer and trapper. He says he cut, hauled out and set up the first telegraph poles between Baltimore and Washington, and just missed going into partnership with Professor Morse. He is greatly interested in electricity and has all the latest publications on the subject. One of his hobbies is electric lighting, and last winter he constructed several powerful storage batteries and had them carefully put away in one end of the cellar under his little cabin of a house. When any stray hunter or berry-picker strolled his way and asked what he was doing, he replied: "Wait until it gets hot next summer and you will see." When that time came, "Uncle Sile" ran a tall, iron lightning rod up from one peak of his house and connected the lower end with his storage battery by means of a stout copper wire. Often when a dark cloud sailed overhead and rain began to patter on his roof, bright sparks were seen to go skipping down the rod *en route* for the storage batteries.

One night, about a month ago, so the narrative continues, a large party of New York and Boston sportsmen were out on the plains in front of "Uncle Sile's," when they all dropped their guns and stood awe-struck at the sight before them. The house, which a minute before was in darkness, now was ablaze with light from ridgepole to groundsill. A gaudy arc of light leaped into the air from one end of the house and settled down upon the other end, while both the windows and the solitary door were framed in such a glow as was never before seen in Cherryfield. "Uncle Sile" had let loose his bottled lightning. He told the wondering gunners that he had electricity enough in his storage batteries to last him from then until the middle of June, when the thunder showers would enable him to lay in a new supply.

.... The order denying the application of the American Rapid Telegraph Company for an injunction restraining the city authorities from removing its poles and wires in New York city has been affirmed by the Supreme Court general term. It is held by the court that the legislature did not intend to subject the company to any unlawful expense or deprive it of any of its property, but to clear the public streets of unsightly and dangerous obstructions, this being a matter clearly of legislative jurisdiction.

A Plaintive Appeal.

Recently a woman entered a suburban telegraph office, says London *Tid-Bits*, and said to the receiver of messages that she desired to telegraph her husband, who was in the country, for money. He pointed her to the counter supplied with blanks and told her the rate for a dozen words. She struggled away for a quarter of an hour and then handed in the following:

"Won't you please send me £5 by next post?"

"I don't know whether that will do or not," she said, as she felt for money. "If you were to receive such a telegram from your wife, would you forward the money?"

"Well—well, I might," he replied, in doubtful tones.

"Now, you wait. I don't like the telegram at all, because I tried to keep it within 12 words. I'll write another."

She tore it up, walked over to the counter, and in three minutes handed in a new one, reading:

"Am out of food and fuel and want £5 as soon as you can get it here. If you can't spare it, I'll pawn the parlor carpet."

"That would bring the money from me," said the receiver, as he read the lines and marked the number of words.

"Then it will from him. Send it quick."

The Frey Electrical Balance or Reversible Bridge.

This instrument, designed by Mr. Charles P. Frey, chief electrician of the Greeley electrical laboratory, is specially adapted for rapidly measuring both high and low resistances with unusual precision. It is to be used in connection with an adjustable resistance box or a B. A. pattern standard coil, and takes the place of the bridge coils which form part of the rheostat of conventional pattern. Its peculiar feature is that its bridge coils can be tested by reversing or interchanging them, an operation which can be speedily performed. Should any inequality exist, it can be quickly corrected.

Both bridge coils are shunt-wound upon one spool, and can be removed to give place to others of higher or lower resistance.

A wire bridge with subdivided half-meter scale can be attached.

This apparatus is being placed on the market by The E. S. Greeley & Company, New York, proprietors of the Greeley Electrical Laboratory.

Important, If True.

The best electrical superintendents and managers, my friend informs me, are usually men who may be described as graduated workmen. That is to say, they are men who have begun as workmen on or about electrical plants and workshops, and have developed business capacity which fits them to undertake the work of management. There is, to be sure, a supply of young electrical engineers growing up, and the material thus supplied, often in the shape of young men of good family and superior education, is improving. At the same time, the knowledge that is gained in schools and colleges about electricity is often too theoretical, and actually unfits men to manage practical enterprises in that field. Nothing, in fact, is more common than for a young man who has been studying and experimenting for six months or a year to imagine that he knows more than Edison himself. At the same time, intelligence and general attainments count in this field as in others, and young men who are willing to begin at the foot of the ladder and learn the electrical business from the humble task of lineman up are, in many instances, achieving substantial success in the new profession.—*New York Star*.

TELEGRAPHIC

.... The Great North-Western Telegraph Company has opened an office at North Bay, Ont.

.... Mr. Martin, an English mine inspector, thinks that electricity is safer than fuses for firing blasts.

.... The Western Union Telegraph Company are putting two 19-wire cables into their main office at Salt Lake City, Utah. The cables run from a distributing pole into the office.

.... A force of men, who have been at work constructing the telegraph line between Red Buttes and Park City, Utah, will put up the line on the Cheyenne and Northern extension.

.... Mr. J. C. Ford, superintendent of telegraph of the Chicago, St. Paul & Kansas City Railroad, is arranging for the beginning of work on the Diagonal line from St. Joseph to Kansas City.

.... The telegraph line of the Western Union Company has ceased to do business north of Sierra City, Nevada, for the Winter, and now Plumas county has no communication with the outside world.

.... Orders have been received at the Western Union Telegraph Company's headquarters in Kansas City, Mo., making a reduction of rates of from 30 to 40 per cent. on business to Kansas, Nebraska, Colorado and New Mexico.

.... The annual meeting of the Northern Telegraph Company was held at Manchester, N. H., December 30th. Ex-Governor Frederick Smyth, John B. Clarke and Hon Charles H. Bartlett, were elected directors, Mr. Smyth president, and Mr. Bartlett clerk and treasurer. A three per cent. dividend was declared.

.... Dispatches from Tacoma, Wash., tell us that the telegraph wires along the Northern Pacific Railroad, which were prostrated by a wind storm on Christmas morning, are now all working. The wires over the mountains were generally broken by falling timber. The greatest velocity of wind reported was 27 miles an hour.

... The Cooper Union Free School in Telegraphy for Women is one of the valuable features of the trust made by Peter Cooper for the advancement of education, science and art. The trustees have arranged with the Western Union Telegraph Company to supply the necessary apparatus and the examination of pupils as to proficiency.

.... The Mexican Telegraph Company have declared a dividend of 2½ per cent. for quarter, payable January 7th. Statement shows surplus, above charges and dividends, $36,828, and total surplus is $167,698. Central & South American Telegraph Company have declared a quarterly dividend of 1¾ per cent., payable January 7th. Surplus for quarter (approximated) shows $19,551, making total surplus $324,085.

.... Frank B. Jeffries was arrested at Baltimore, January 1, for tapping the wires of the Western Union Telegraph Company which supply the pool rooms at Arlington, Baltimore, with reports from the race tracks. Jeffries is supposed to be connected with the party who were arrested in Washington and released on bail, charged with tapping wires in that city. The police captured a complete office outfit, including 50 cells of battery, two instruments, and fifty pounds of wire.

.... News comes from Winnipeg, Manitoba, that the Canadian department of public works have issued a new tariff for the government telegraph lines in the Northwest. It will materially reduce the telegraphic tolls. All the 75 cent charges for messages under the old tariff were reduced on January 1st to 30 cents; that is the most it will now cost to telegraph from any point from Prince Albert to Qu'Appelle. The government telegraph lines cover a vast extent of country, and, in view of this, the charges are very moderate.

* * Fargo and Moorehead, Dakota, are to have an electric street railway.

* * Terre Haute, Ind., is enjoying the luxury of electric street railway service.

* * The advent of the electric street railroad to Andover, Mass., has created quite a boom in real estate.

* * The Consolidated Street Railway Company, at Helena, Mont., has commenced running electric cars exclusively.

* * Franklin B. Colton, a member of the Wilmington, Del., city council, has purchased the controlling interest in all the street railways of the city. He will change the motive power from horse to electricity.

* * The Cornwall Street Railway Company is laying rails from Whatcom, Wash., to the adjacent towns. Ex-Senators Platt and Hiscock, of New York, are reported to have applied for a franchise for an electric street railway.

* * The stockholders of the Holyoke, Mass., Street Railway Company met last week, and voted to increase the capital stock from $50,000 to $150,000, for the purpose of equipping the various lines with electricity in the Spring.

* * Samuel Lesem, of Denver, says he has been granted rights and franchises by the Mexican government for the introduction of electrical enterprises. He expects to build 250 miles of electric railways and spend $5,000,000 doing this and other electrical things.

* * The Schuylkill Electric Railway began operations at Pottsville, Pa., December 23d. The road is on the Short single trolley overhead system, and was installed by the United Electric Equipment Company, of Philadelphia, under the direct supervision of Mr. C. R. Eberle, of that company.

* * The Metropolitan Traction Company, of New York, controlling the Broadway & Seventh Avenue Railroad, the Broadway Railroad, the Twenty-third Street Railroad, the Houston, West Street & Pavonia Ferry Railroad and the Chambers & Grand Street Ferry Railroad, has voted to increase its capital stock from $10,000,000 to $20,000,000, for the purpose of improving its properties.

* * January, 19, 1891, there will be a meeting of the Troy, N. Y., and Albia Horse Railroad Company, to discuss a proposition to increase the capital stock of the company from $50,000 to $400,000. The increase is for the purpose of defraying the expense of substituting electricity as a motive power instead of horses. The necessary consent of the property owners along the line of the road has been obtained.

* * Owing to the consolidation of the Villard properties in Milwaukee, superintendent Linn, of the Cream City Street Railway, will retire, and superintendent Hommel, of the Milwaukee City Company, will assume managerial control of the consolidated corporations. The officers of the new corporation are as follows: Henry Villard, president; Henry C. Payne, vice-president; directors, Charles L. Colby, Colgate Hoyt and W. J. Curtis, of New York; Frank G. Bigelow, of Milwaukee, and David S. Wegg, of Chicago.

* * Increased business warranted the Boston electric lighting companies in reducing prices on incandescent lights at the opening of 1890 about 12 per cent., and a further reduction in 1891 would not be surprising, owing to the great extension of the business and the good prospects of growth. In arc lighting the reduction was even greater, owing to the effort of the city government to get lower prices. Boston was paying 65 cents per night, which was about the highest price paid by any city in the country, but the new rate of 40 cents per night brings it down to an average price.

PROGRESSIVE ELECTRICAL INVENTIONS.

ELECTRIC CAN SOLDERING APPARATUS.

An ingenious application of electricity to the soldering of caps upon cans in hermetically sealing canned goods has been made by Mark W. Dewey, of Syracuse, N. Y. Electrodes constituting the terminals of a circuit containing a source of energy, such as a storage battery yielding sufficient volume of current to heat the top of the can and flux the solder, are brought into engagement with the top of the can after the solder or cement has been applied, and a rotary movement is

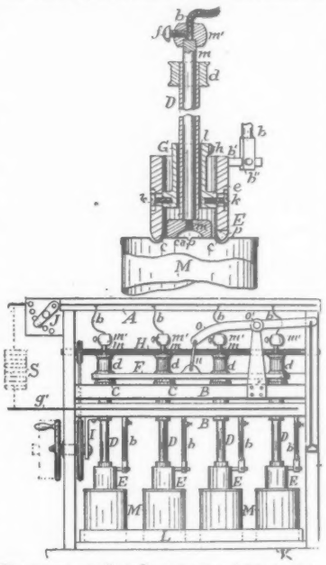
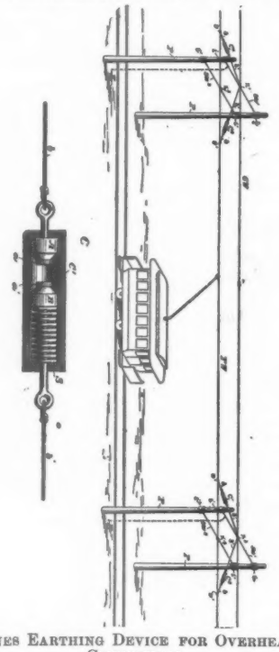


DIAGRAM OF CAN SOLDERING APPARATUS.

imparted to one electrode in order to distribute the solder uniformly and make an effective junction. In the accompanying engraving, which illustrates the apparatus employed, the detached figure shows the position of the electrodes with relation to a can, and the principal view shows a series of cans with the operating mechanism for soldering the caps. The two electrodes *m* E, which may be made of copper or any conducting material, are separated by insulating material *l*, and arranged so that they may be independently raised or lowered with relation to the can. The inner electrode *m* forms a pressure-bar for holding the cap of the can in place. The outer electrode E is secured by screws to a sleeve connected with pulley *d* to which is imparted a rotary movement by a belt. A lever *o* may operate to raise the soldering electrodes away from the can. One terminal of the circuit is connected directly to the central electrode, as shown at *b*, and the other terminal connects with the bracket *b* which carries a brush b^1 bearing upon the outer rotary electrode. The filled cans with applied caps are placed in the machine, the electrodes being raised sufficiently away from the cans in order to permit their introduction. The solder or cement is laid around the edge of the cap and the electrodes are lowered into position, the pressure-electrode *m* holding the cap firmly in place. The current may be regulated to the most suitable strength by means of a switch J and a rotary motion is imparted to the pulleys *d* which thus sweats the parts together while the heat is developed by the current. After the junction is effected the outer electrode is raised from the cap, the pressure-electrode remaining in contact until the solder or cement has set sufficiently to make the joint firm. The several series of electrodes are connected in multiple arc relation to the source of energy, as shown, though a series arrangement might be practicable. Rapid and efficient work may be thus conducted, utilizing the electric current as a source of heat in lieu of the other more or less troublesome modes of heating soldering irons heretofore employed.

EARTHING DEVICE FOR OVERHEAD CONDUCTORS.

The extended application of overhead conductors carrying high tension currents to commercial uses makes it necessary that every precaution should be taken in case of rupture of the circuit that human life shall not be endangered by accidental contact with the fallen terminals. In the accompanying engraving is represented a method proposed by Francis W. Jones, of New York, for automatically grounding the circuit at or near the supports for the overhead conductors, so that the terminals of such conductors when ruptured will be reduced to zero potential and liability to shock be rendered *nil*. The device is very simple in character, comprising simply a non-conducting box C^1, shown in the detached figure, containing two electrodes, one of which is spring-actuated, such electrodes being normally held out of contact by the tension of the stretched wire T W carrying the supply current. An auxiliary guard wire G W is carried along the circuit and is grounded at intervals of the circuit, as, for example, at every supporting pole, as illustrated by the dotted lines in the diagram. If a rupture of the wire T W should occur, the strain upon the spring S will be reduced and the circuit will be closed at contact A B by means of the tension of the spring, thus grounding the circuit T W at the supporting pole near which the break occurs. The guard wire has also the advantage that in case any foreign wire should fall across it and dangle to the ground in such manner as to touch both the guard wire and the electric wire, the section of the foreign wire between



JONES EARTHING DEVICE FOR OVERHEAD CONDUCTORS.

the two other wires will become a path for the current to flow to earth by way of the guard wire and its earth connections, shown by the dotted lines; the dangling end of the foreign wire will thus have its electric potential reduced almost to zero and be rendered harmless to life and property.

Electrical Fixation.

The committee "on Fixation of Electrical Standards," just appointed in London, is in for a hard time.

By what standard are you to measure the electrical flash of a pretty girl's eye? Where be your ohms and your volts on fixing that kind of fixation? This is the sort that Ajax never defied nor Franklin explained, though he felt it. Can a mere physicist reduce it to system?

How many amperes, pray, in a jorum of Jersey lightning; and why, in a stately forest of presidential timber, does the bolt so often light on what Emerson called "mere punk?"

Fixation, indeed! Let the committee have its creative resolution amended so as to confine its scope to the chemical and mechanical articles, and then, if it can (for no one else has been able to do it), explain why the shock that will kill one man will only make another feel like dancing.—*New York World.*

The Heisler Electric Light Company, of Philadelphia, has greatly increased its manufacturing facilities, and is completing arrangements for actively pushing its business. This company has done a very good business during the past year, but now with enlarged facilities will be able to greatly increase the output.

The Storage Battery Decision.

Mr. D.H. Bates, of the Electrical Accumulator Company, in speaking of Judge Brown's recent decision in the suit of the Electrical Accumulator Company against the Brush Electric Company on the question of interference between the Faure and Brush storage battery patents, says:

"The suits instituted by the Electrical Accumulator Company against the Brush Company in the Ohio district, to determine the respective standings of the Faure and Brush patents had, owing to the dilatory proceedings instituted in great part by the defendants, progressed no farther than the preliminary pleadings, and the merits of the case have not been brought into question, and no testimony has been taken.

"It is in this case that Judge Brown has made an interlocutory decision, involving three questions of law and fact, as follows:

"'The Accumulator Company applied to the court for leave to dismiss the two interference suits, alleging that, owing to the construction placed upon the Faure patent by Judge Coxe there no longer remained any interference. In one of these cases, namely, the one in which the Faure patent was an interference with the Brush patent, 337,298, the court decided the motion in favor of the Accumulator Company; in the other case, Judge Brown held that the question of the expiration of the Brush patent, by reason of the prior grant of the Italian patent, could not be decided until after the full hearing, and hence sustained the demurrer of the Brush Company to that portion of the Accumulator Company's bill, leaving the case to proceed on its merits.'

"In the same case the Accumulator Company filed a supplemental bill, setting up that since the disclaimer filed to the Faure patent, there was no longer any interfence between the first claims of the Faure patent and the formerly interfering claims of the Brush patent. The Brush Company filed a demurrer to that supplemental bill, on the ground that this question could not be tried in that case, and Judge Brown also decided this question in favor of the Accumulator Company.

"The facts are, therefore, that in the recent case three points have been decided, two in favor of the Accumulator Company and one in favor of the Brush Company, leaving the case still to be tried on its merits.

"The Accumulator Company claims, and its claims are based upon a long and wide experience in the business, that no form of storage battery, so far made, has proved or can prove successful, except that made by the Faure process where the active material is applied to the support plate in the form of a paint, paste or cement prior to immersion in the battery fluid, and that where, according to Judge Lacombe's construction of Brush's experiments, a perfectly dry powder is compacted upon the grid by a hydraulic pressure and no fluid by the active material causes it to expand and to exhibit a tendency to disintegrate, such tendency being accelerated on the occasion of each succeeding charge and discharge. In other words, a battery so constructed is not durable and breaks down when subjected to any but ordinary strain."

Pearls of Wisdom.

Mr. Edward Atkinson, the eminent economist and president of the Boston Manufacturers' Mutual Fire Insurance Company, when interviewed about the dangers of electric wires by a Boston *Post* reporter, expressed the following opinions:

"We regard a well installed electric lighting system as the safest method of illumination.

"A law fixing the responsibility for fire damage caused by electric wires would cause a greater care on the part of electric companies putting in installations and thereby greatly reduce the liability to fire.

"Telegraph and telephone wires should come under the same category, for while the original current carried on these lines is perfectly harmless, an immense amount of damage may be created by a wire carrying a less volume of electricity coming in contact with one having a high potential. It will be a herculean task to bring about the proper state of things, but it will have to be done sooner or later and everybody would be glad to see it accomplished."

Mr. C. J. H. Woodbury, vice-president and electrical expert of the above company, advocated greater precautions in the way of construction, and suggested that a girder, bridge or box be constructed over the tops of the buildings which should contain all necessary high tension wires, completely protecting them from harm and consequent danger to other wires. Public enlightenment would bring about a better state of affairs, and then closer inspection and restriction would naturally follow.

New York Board of Electrical Control.

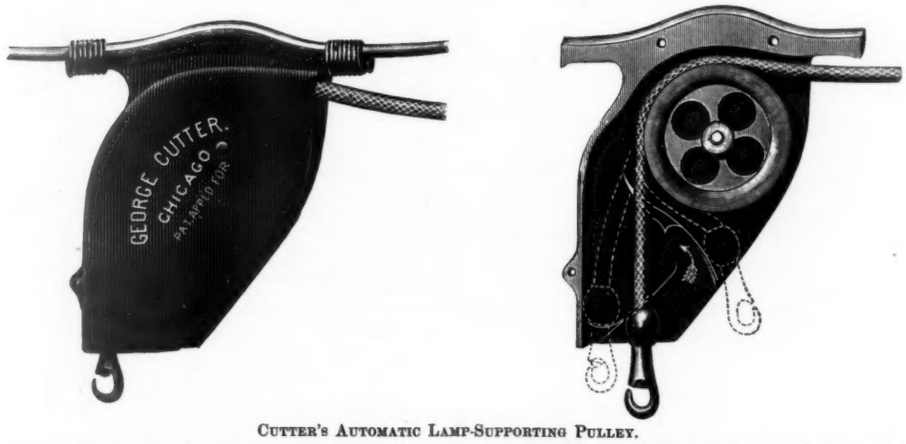
A list of all electric wires running over the tops of buildings is to be prepared for the Board of Electrical Control. Mayor Grant announced at the meeting of the board, held January 2d, that all unauthorized poles and wires would be removed.

An application was made to the board by the Harlem & Fordham Surface Railroad Company for permission to do away with horses and substitute electricity as a motive power. The electricity, if permission is granted, will be carried on overhead wires.

Expert Wheeler said that the system was mechanically safe, and Corporation Counsel Clark said there was no legal impediment to its use. The matter was laid over for two weeks.

Cutter's Automatic Lamp Supporting Pulley.

Every one who has had experience with arc lamps knows how important it is to fasten the hoisting rope securely, since its slipping means the dropping and probable ruining of the lamp. To have the pulley support the lamp when raised is done in Cutter's lamp supporting pulley. This is a sleet proof pulley, with a series of ridges projecting from its sides, and adapted to engage the knob of the hook from which the lamp is hung. When the lamp is raised, these ridges guide the knob until it strikes the curved stop shown in the cut; then, on slackening the hoisting rope, the weight of the lamp pulls the knob over into the lower corner of the pulley. This leaves the lamp



CUTTER'S AUTOMATIC LAMP-SUPPORTING PULLEY.

supported entirely by the pulley, yet, after raising it again until the knob passes the corner of the upper guide, it can readily be lowered. The cut shows how the knob is guided in and supported by the pulley, and also how it is guided out. Thus it is evident that raising the lamp until the knob strikes a dead stop and then slackening the rope, leaves the lamp supported by the pulley; repeating the operation disengages it so that it can be lowered.

The way in which this pulley is fastened to the suspension wire, and kept from slipping along the wire, is a good feature. The two wires, as shown, are wrapped around the ends of the pulley, and around the suspension wire which rests in the grooved upper edge of the pulley. This fastening puts a kink into the suspension wire, and this keeps the pulley from slipping on this wire.

This automatic pulley will evidently adapt itself for use wherever arc lighting is carried on, and is one of the new specialties which George Cutter, of Chicago, is putting on the market.

"No well regulated municipal government permits private corporations or individuals to own or control in any way its supplies of water and light."—*Philadelphia Record.*—What miserable municipal government we have in this mean country!

The employés of the New England Telephone and Telegraph Company, suburban division, have presented Supt. Hanson, of Boston, with a fine gold watch, chain and charm. The presentation speech was made by Mr E. T. Timothy and was appropriately responded to by the recipient.

Electric Lighting Situation in London.

[From the London *Electrical Review*]

The recent destructive fire at the Grosvenor Gallery station of the London Electric Supply Corporation, limited, followed by a second disaster, which completely broke down the partially repaired transformers which had been previously damaged in the conflagration, has been the means of effectually stopping the supply of electrical energy to every customer in the district covered by the corporation. How long this delay will continue we are unable to determine; but the misfortune which has befallen the supporters of the high tension scheme seems likely to be followed by a host of minor failures which will probably affect electric lighting companies generally. A glance at the columns of the *Times* reveals a state of affairs which does not, to a casual observer, (that is if the Parliamentary question of Mr. R. Chamberlain, M. P., into the doings of a well-known supply company should be successful in throwing dust into the public eye), suggest that would-be consumers can yet place a proper degree of reliance in the *bona fides* of electric lighting systems. This gentleman has taken it upon himself to ask in the house whether the attention of the board of trade had been called "to a long continued default of the Chelsea Electric Supply Company to furnish the statutory current of 100 volts, and to the serious loss of illuminating power sustained by consumers in consequence?" He also desired to know whether the board of trade would take steps to compel the company "to keep faith with the public, or forfeit their concession?" Mr. Irving Courtnay, the chairman of the Chelsea Company, in a letter which appeared in our daily contemporary on Monday last, completely demolishes, to his own satisfaction, Mr. Chamberlain's implied charges; but as his communication is directly followed by another from the M. P., reiterating his Parliamentary statements, the public may not easily be able to discriminate between the rights and wrongs of the matter at issue.

Mr. Chamberlain contends that the lamps supplied by the company are intended to be used at 100 volts terminal pressure, and he finds that, notwithstanding repeated complaints, he gets only 96 to 98 volts. He is apparently ignorant of the fact that the board of trade allows a variation above and below of four per cent., and it is upon this point that the company justifies itself.

Mr. Chamberlain asserts that, with a pressure of, say, two to four per cent. below the specified voltage, he is left in semi-darkness; but in this he exaggerates, for Sir David Salomons has shown that for a loss of somewhat more than half the light, the fall in voltage must be about 10 per cent., whereas double illuminating power can be gained by an increase of four per cent. over the normal difference of potential. It is possible that the company might endeavor to keep nearer to the 100 volts for the sake of pleasing its customers; but, as we imagine the conditions under which supply is guaranteed are known to householders, it will be seen that the complaint, if any, should be directed not against the Chelsea Company but against the board of trade for having allowed so much latitude to suppliers.

There are other letters complaining of the uncertainty of all consumers getting current during the time when the London Electric Supply Corporation was generating electrical energy, but it is well-known that in early days the demand was greater than the supply, and, altogether, we fear that the correspondence in the *Times* will have a damaging result upon electric lighting if some steps are not promptly taken to counteract its ill effects.

We have many times pointed out the difficulties which must be encountered in keeping the insulation of high tension apparatus intact, and the interesting experiences of Mr. Gisbert Kapp, to which we refer in another column, completely bear out our contentions with regard to transformers. It will also be remembered that Mr. Ferranti's mains have come in for their share of criticism at our hands, and we cannot but think that the concluding remark in his letter (see our correspondence columns), with regard to his opinion on insulating materials, will not prepossess electricians in its favor, but, doubtless, the advocates of the insulator which he so ruthlessly puts aside will have something to say in its defense, although that is hardly required.

India rubber has been tried and proven, although in some instances faulty designs of leads, or ignorance of the precise purposes for which they were required, may have led to failure of insulation; but the Ferranti conductors have not yet been through that test of time which is necessary in order to show whether they confirm the views of their designer or come to the end which has been prognosticated in other quarters. Mr. Ferranti's belief in his mains is unbounded, but he admits the difficulty of insulating both generators and transformers under an alternating difference of potential of 10,000 volts; now that work has been shut down for a time, would it be too much to ask the London Electric Supply Corporation to carefully consider its future, and to seriously entertain some modification in its high pressure method, if that future is to be either technically or commercially successful?

The corporation must not merely debate its own position, *per se*, but it should give due consideration to the many firms whose work in wiring and fitting is largely dependant on the increasing number of its customers, for these contractors suffer as well as the public.

We have often urged that a failure, or even a partial stoppage of the Deptford works, would be disastrous to the electric lighting industry; we fear that the truth of our warnings, which were then disregarded, are beginning to make themselves apparent, and we would, as friends, also suggest to Mr. Ferranti the absolute necessity of thoroughly reconsidering his plans. He has now, by sheer misfortune, got the opportunity for which he has always asked—a period of inaction in which to bring every part of his producing and distributing plant into thorough order—and we trust that he will, not withstanding a heavy secession of consumers, neither shorten the time that is necessary for perfecting his work, nor spare any effort which shall tend to render a repetition of the mishaps impossible in so far as human ingenuity can be sure.

To guard against men of Mr. Chamberlain's stamp, we would strongly advise electric light companies to hold as near to their undertakings as possible, and not to merely keep within the limits of the percentage allowance. Judging from the eulogistic terms in which some supporters of the Kensington House to House Electric Supply Company speak, it is not a serious matter to give customers exactly what they expect and to which they are entitled.

—— The fifth quarterly dividend of two per cent. on all the stock of the Edison General Electric Company, including such stock as is held in trust by the Farmers' Loan and Trust Company, has been declared by the board of trustees due and payable on February 2, 1891, at the office of the company, to holders of record December 29, 1890, the payment of dividend on the above stock held in trust by the Farmers' Loan and Trust Company, being, however, subject to the ratification of the action of the board of trustees dissolving the trust, by the stockholders at their regular meeting on January 19, 1891. The transfer books were closed at 3 P. M. on December 29, 1890, and will be re-opened on February 3, 1891.

ELECTRIC LIGHT NEWS

—— According to statistics, there are 21 central electric lighting stations in Germany. The horse-power employed is 20,975.

—— The Brush Electric Light and Power Company, of Savannah, Ga., has declared its usual semi-annual three per cent. dividend.

—— A fire at Clinton Prison, Plattsburgh, N. Y., January 1, destroyed the dynamo and other electrical apparatus designed to kill murderer Wood.

—— A large lumber mill at Redington, Me., has been supplied with a 30 arc light plant, through the agency of the Kendall & Slade Electric Company, of Boston.

—— There are now nearly 1,900 public electric lamps burning in St. Louis, and 220 more will be ready soon. It now costs about $6,000 a month less to light the streets, alleys and public buildings than it did under the old gas contract to light the streets alone.

—— The Philadelphia *North American* informed its readers that when Chief Walker, of the Electrical Bureau, cut some unauthorized electric light circuits, "many of the stores would have been left in darkness had it not been for the fact that they had gas *yets* in their establishments."

—— Judge Gordon has continued the preliminary injunction which was granted December 26th, restraining the City of Philadelphia and its officers and agents from cutting or in any way interfering with the wires or other property of the Electric Power Company. The injunction is continued until the further order of the court.

—— Orders have been given by the French Minister of War for the construction of iron-clad light towers for use in the fortresses along the banks of the Maas. The light will be supplied by a powerful arc lamp with fixed focus, and the approach of an enemy at night without detection is thus rendered impracticable. The dynamo will be driven by a gas engine.

—— The Somerville & Raritan, N. Y., Electric Light Company, held a meeting recently and elected a new board of directors composed of Messrs. J. W. Ballantine, A. M. Young, J. P. Major, J. L. Griggs, J. Brown, L. M. Coddington and D. K. Craig. The following officers were elected: J. W. Ballantine, president; D. K. Craig, vice-president; J. L. Griggs, treasurer; J. P. Major, secretary. It was voted to increase the capital from $30,000 to $50,000 to make extensive improvements.

—— In the suit of the Brush-Swan Electric Light Company against the Brush Electric Company, which is pending in New York in the United States Circuit Court, and in which certain patent rights are concerned, Judge Cove, on January 2, made an order permitting the defendent to make any sales of electrical machinery, apparatus, and supplies in territories mentioned in a previous decree, provided it sets aside a commission of 20 per cent. on all moneys received pending the final adjudication. This fund will be paid into the hands of the plaintiff company, provided it files a bond of $25,000; otherwise it must be turned over to Commissioner Shields as registry of the court.

—— The contract for lighting certain sections of Philadelphia, held last year by the Brush Electric Light Company, was awarded for the current year to the Electric Light and Power Company. By the terms of the contract the latter company forfeited its privilege and $5,000 in addition if it failed to supply the illumination on the night of January 1st. The lamps and wires were all in position and working well at nightfall, but shortly after six o'clock all the lights in one section went out. President Esher of the Electric Power Company, according to press dispatches, asserts that the Brush Company cut the wires in several places in order to embarass its rival and cause its contract to be forfeited. Legal proceedings are threatened.

Municipal Ownership of Industries.

BY ALLEN R. FOOTE.

[NOTICE.—This paper was written with the expectation that an opportunity would offer to read it before The American Economic Association at its fourth annual meeting, held in Washington, D. C., December 26-30, 1890. After Prof. Edward W. Bemis had read his paper on "The Municipal Ownership of Gas Works in the United States," no such opportunity occurred for want of time. It is presented to the public with the request that it receive careful consideration and well thought out criticism.]

1. Those who know me know that this is a subject in which I take a deep interest and on which I have an opinion. As I had no opportunity to learn what Prof. Edward A. Bemis, of the Vanderbilt University, of Nashville, Tenn., would say in his paper on "The Municipal Ownership of Gas Works in the United States," it has not been possible for me to prepare a review or a discussion of his presentation of the subject. I shall, therefore, discuss it in general terms.

2. So far as I am aware, the policy of the municipal ownership of the manufactured gas industry is advocated by professors of economy on the broad ground that it is a means of securing an economic advantage for society. I presume such professors will agree with me in the general statement that: *That system of economy is best which most surely tends to enable the poorest member of society to become richer.*

3. To reach a solution of this problem it is necessary to inquire in what way does the policy of municipal ownership tend to enable the poorest member of society to become richer? Two different methods for manifesting the economic advantage to be gained by such ownership are in operation.

First.—Operating the plant for the purpose of creating a profit; the profit being used to reduce taxation for special or general purposes.

Second.—Operating the plant without the intention of making a profit, for the purpose of supplying consumers at actual cost of production.

For the purpose of the present inquiry, I will not consider any question relating to the initiative of the ownership, or to the administration of the plant. For the sake of the argument, I will concede that everything in that direction is all right, and that the plant and its operation is an exposition of the best attainments possible to municipal ownership. This enables thought to concentrate upon the direct question at issue. To solve the problem, the effect of each method of economic manifestation must be considered upon its own merits.

4. *Operating a municipal plant for a profit, the use of the profit being to reduce taxation.*

Gas, for illuminating or heating purposes, is a commodity of consumption, therefore, the profit made by a municipality on the sale of gas is a tax on consumption. It is self-evident that the higher the price of gas, the greater the profit will be, up to the taxable limit of the industry. The greater the profit, the larger the fund to be used for the reduction of special or general taxation.

The selling price is the same to all consumers. The profit per 1,000 feet on the gas consumed by the poor is exactly the same as the profit per 1,000 feet on the gas consumed by the rich. Under this system, the poor not only pay the same rate of tax per 1,000 feet as the rich, they also consume much more gas per dollar of their income than do the rich. These two facts, fairly considered, fully justify all the fine frenzy of denunciation of indirect taxation to be found in the fourth chapter of "Taxation in American States and Cities," by Prof. Richard T. Ely. The character of indirect taxation, as described by this author, may be sufficiently indicated by a quotation of some of the head-lines of the subdivisions of this chapter. They are as follows:

"Indirect taxes are chiefly taxes on commodities."

"Indirect taxes violate the principle of equality."

"Indirect taxes and pauperism."

"Indirect taxes obstruct trade."

"Indirect taxes congenial to despotism and aristocracy."

In view of such teaching, one must conclude that the economic results of operating a municipal plant to create a profit, tend to make the rich richer and the poor poorer, a result the reverse of that which should be realized by an economic system, designed to secure "the greatest good for the greatest number."

5. In this result may be found a logical reason why "the best people" in a community, where such a system is in vogue, desire its continuance. Under such conditions, any man having a large income can afford to pay twice or three times the price he does for the gas he consumes, since the amount saved to him, through the reduction of his taxes by the profit on the gas bills of 1,000 other consumers, is far greater than his share of the excessive price. This is why the citizens of Philadelphia are to-day paying one dollar and a half per 1,000 feet for gas, when, if the plant were owned and operated as a private industry, the price would be but one dollar per 1,000 feet. Every wealthy man in Philadelphia has 1,000 poor people assisting him to pay the just taxes of wealth. The poor deluded creatures are content to do this, because they think by owning their own gas works, they have slipped from under a grinding monopoly. This criticism shows that an apprehension of—wherein lies the economic advantage in any problem—is an instinct with the rich, while, if the poor have it at all, it is with them an acquired taste. It further explains why there are two classes of people, the rich and the poor.

6. *Operating a municipal plant for the purpose of supplying consumers at the cost of production.*

Of the two methods considered, this is the most equitable. By it, the rich gain only the advantage of the saving on the gas they consume, and the gain of the poor is on the same basis. The gas bills of the poor being a larger percentage of their income than are the gas bills of the rich, the economic advantage gained by the poor under this method, effects a larger percentage of saving for the poor in proportion to income, than it does for the rich. Therefore, this method "tends to enable the poorest member of society to become richer." It obtains "the greatest good for the greatest number." It causes, so far as the economic advantage is concerned, the poor to grow richer, and the rich to grow poorer, because it leaves the taxes for the rich to pay. This would be the result of an equitable distribution of wealth.

7. It is evident that from the foregoing, if the economic advantage obtained by the community through the price paid for this service, is to decide policy of municipal ownership of industries, then those who advocate private ownership must accept the issue on this basis, and be ready to show that they can and will perform the same service for the same price that the community pays for it under municipal ownership and administration.

A condition precedent to the settlement of this question is an agreement on what constitutes cost of service under municipal ownership. It was to establish this agreement, that I offered the resolution Saturday evening last, after Prof. Henry C. Adams had read his admirable paper on "Statistics as a Means of Correcting Corporate Abuses." Please notice carefully the wording of those resolutions; they are:

"*Resolved*, 1st, That a committee be appointed to designate the divisions of accounts, and the items to be included in each, that should be kept by corporations performing quasi-public services.

"*Resolved*, 2d, That said divisions be so made that the effect of each essential economic factor will be shown, to the end that correct statistics may be obtained through a uniform method of accounting, as a basis for intelligent, economic discussion and legislation."

8. We must first agree on what items constitute cost, then we must see to it that these items are honestly included in all statements of cost. This done, we are now in a position to take intelligent action, and may then award the contract to the municipality or to private enterprise, whichever, in the light of the facts so obtained, may appear to be to the best economic advantage of the greater number of people, those who toil and are poor.

Assuming that no economist will take issue with me regarding this fundamental basis for an agreement, I will advance one step farther and claim, until such a basis is agreed upon and the accounts are made in accordance with its requirements, there shall be a suspension of judgment and action. By adhering to this policy all parties will not only avoid the liability to get into positions from which they will have to recede when the statements of cost are correctly made, but large invested interests will cease to suffer from attacks that would not be made, if those who utter them were better informed.

I urge this claim upon you for another reason. I, like all not to the manor born, have a lofty ideal of nobility. I feel it to be a personal belittlement to be obliged to lower it. According to my ideal the noblest men are they who worthily fill the station of teacher. What wonder is it then that I should feel hurt when I see some that occupy such stations, giving currency to statements that tend to lessen the respect for, and, therefore, the influence of those who utter them? When professors of economy give currency to statements of the cost of production which practical men, in the light of the accounts they are daily keeping, know are not true, they must not wonder if they find themselves and the educational institutions with which they are connected, held in small estimation. The profession cannot afford this any better than business interests can afford to suffer from the attacks of the uninformed. Here again, I think, we have a point of agreement. Let us join hands upon it and take as our guide to action—whose cause truth will not serve, is lost. That truth may be established, no statement of a demonstrable fact should be made without an analysis of the conditions to show that the conclusion reached is correct.

9. Having in part explained my views and position to you, I feel it right to tell you I look upon statistics as being as potent a *means of correcting the abuse of corporations*, as for correcting abuse by corporations. To sustain myself in opposing the principle of governmental ownership of industries, in whatever form it may take, I invoke the same power as do those who favor that principle.

Take the accounts of all the industrial plants owned by municipalities and write them up completely from the date of their initiative until now and you will find that the communities that have entered upon those experiments have not gained an economic advantage.

Private enterprise stands ready to-day to take over every one of these plants and perform the service at the same price such accounts will show it is costing the community where it is rendered, provided the municipality will grant the same economic advantages assumed by itself, which are:

An untaxed investment, an untaxed, exclusive and perpetual franchise.

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* * Electricity is about to be used as a motive power in a mining district of Colorado which has been handicapped heretofore by the great cost of fuel and the difficulty of getting it. There is abundant water-power in the neighborhood, but not at the places where power is wanted. It will be an easy matter, however, to use the water-power for the generation of electricity, transmit the latter by wire to any desired place within a reasonable distance, and there convert it into power. Thus, by the agency of the dynamo and with the aid of water-power, mines may be developed that could not be worked if the generation of power depended upon the transportation of coal or other fuel from distant States. This is a happy illustration of the application of inventions to particular uses. Nothing new is to be used, but the projectors have simply found a place where the combination of known machines and processes will yield them the power they require at less cost than local steam engines. —*Philadelphia Ledger.*

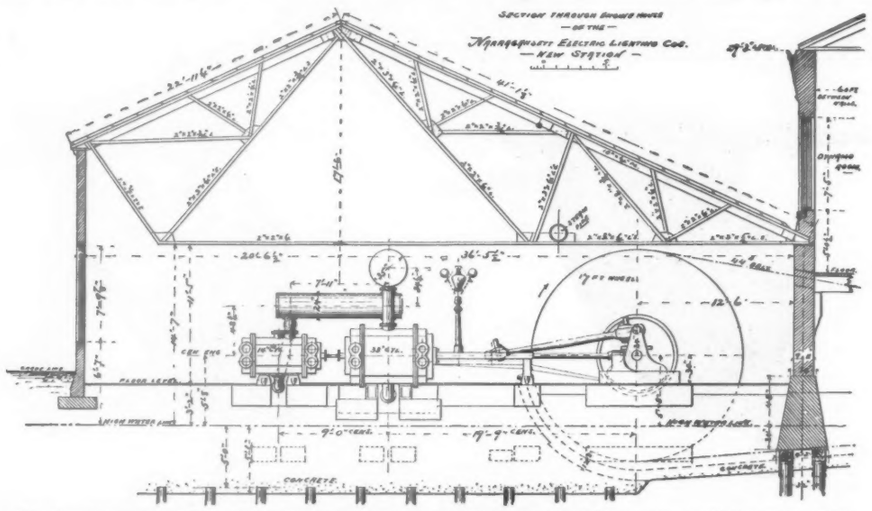

FIG. 1.—SECTIONAL VIEW OF THE ENGINE ROOM OF THE ELECTRIC LIGHT STATION, AT PROVIDENCE, R. I.

The Pleasure Is Ours.

Our thanks and the greetings of the season are due to the following named firms for their courtesy in remembering us with 1891 calendars which have never been used before. What's that the Virginia Judge says? —"'Tis not the walley o' the thing, but the sociability on it. I'll jine you!"

The Pope Manufacturing Company sent one of their perennial and daily useful Columbia pad calendars. This calendar will save the user money and the Pope Company are true philanthropists in distributing them so freely.

Brown & Sharpe Manufacturing Company, Providence, R. I., didn't send a calendar, but surprised us with a nickel-plated paper weight. The top is made of celluloid and on it is impressed a splendid steel engraving of the company's plant. Machinery and tools made in such a handsome factory *must* be good.

H. T. Paiste, the Philadelphia electrical specialty man, sent a calendar fastened to a steel engraving. Between the sheets of the calendar are cleverly sandwiched stanzas of commercial rhymes referring to Mr. Paiste's business. The engraving is printed in black, the rhymes in blue and the advertising in red—so by the end of the year it will be "black and blue and read all over."

The Electric Gas Lighting Company, 195 Devonshire street, Boston, were the senders of another steel engraving calendar. No advertising matter appears on the front except the name of the firm and something about "first quarter—last quarter, etc.," probably referring to the fact that if a customer spends his first quarter with them he'll stick until he's spent his last.

The Shultz Belting Company, 225 Pearl street, New York, through Mr. A. B. Laurence, general manager, mailed us a large lithographed calendar, portraying in colors the Shultz trade-mark. "It belts the earth and makes the moon spin like a top."

The Servant Girl Must Go.

Mrs. Mary Lowell is known as the "Electrical Star," according to the New York *Press*, and lately turned her love for electrical engineering to practical account. She was without a servant, and determined to try whether she could not light the kitchen fire by means of a tame flash of electricity, so to speak, and then let it burn up before she got up herself. She prepared wires to and from her bed-head to the kitchen grate, thus completing an electric current with the aid of a small battery, and all that then remained to be done was to so "build" the fire that the materials should become easily ignitable.

The wires were connected by a piece of platinum, and round this there was loosely wrapped what firework makers call "lightning paper." Over this again was strewn some tissue paper, upon it placed a wheel of firewood and on the latter the coal.

At seven in the morning, when the fire had to be lit, the current was sent from Mrs. Lowell through the wires. The platinum lit the lightning paper, then the tissue, the tissue the firewood, and the firewood the coal. When she descended to the kitchen the kettle was boiling and the place comfortably warm. She thinks she has done something toward the solution of the servant girl question.

Electric Light Station Work of the Berlin Iron Bridge Company.

This is one of the most active and enterprising corporations in New England. The company's factory buildings are located at East Berlin, Conn., on the Middletown branch of the N. Y., N. H. & H. Railroad. The company designs and builds metallic structures of all kinds and classes, and its experience in this line of manufacture is very large. A large corps of thoroughly experienced civil engineers are constantly employed, thus enabling this company to promptly and carefully prepare designs and estimates for metallic structures of about every kind.

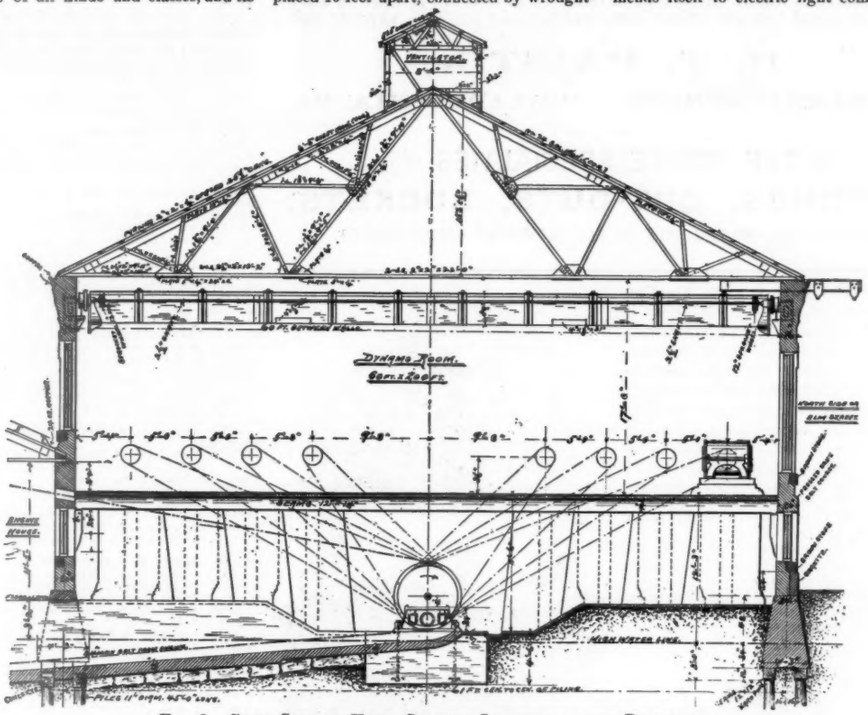

FIG. 2.—CROSS SECTION VIEW, SHOWING LOCATION OF THE DYNAMOS.

As the company's name indicates, metallic bridge work has been in the past the leading feature in its business; but now another important department at the company's works is rivaling if not surpassing in importance and activity the industry just named, and that is the construction of fire-proof electric light and power stations. The accompanying illustrations were taken direct from photographs, and give views of the electric light station of the Narragansett Electric Lighting Company, at Providence, R. I.

Fig. 3 shows an interior view of the dynamo room, and also the inside construction work of the iron roof built by the Berlin Iron Bridge Company.

The dynamo room is 60 feet in width by 200 feet in length, the roof-trusses being placed 10 feet apart, connected by wrought-iron purlins covered with corrugated iron; no woodwork being used about the construction of this building in any part, except for the window casings. Running lengthways of the entire dynamo room is placed a traveling crane with trolley cars running across the building, so that every part of the floor is controlled by these traveling cranes, and in this way the dynamos can be moved, loaded and unloaded, as may be desired.

Fig. 2 gives a cross-section view of the entire station; showing main source of power and the position of the dynamos. This view also conveys a comprehensive explanation of the iron construction work on outside and inside of the station roof.

For electric light stations, this construction particularly commends itself, as being absolutely fire-proof, at the same time economical and permanent. The first cost of such buildings are a trifle more than wooden construction, but when the decreased insurance rates and the increased convenience of the plant is considered, they are much cheaper in the end. The construction commends itself to electric light companies as being economical, and, at the same time, risk from fire is entirely eliminated.

Fig. 1 shows a sectional view of the engine room, which is in an adjoining building, and separated from the dynamo room by a heavy brick wall.

The Berlin Iron Bridge Company has also constructed the new iron roof stations for the following: Waterbury, Conn., Electric Light Company; Putnam, Conn., Electric Light Company; Danbury, Conn., Electric Light Company; South Norwalk, Conn., Electric Light Company; Lynn, Mass., Gas and Electric Company; Quincy, Ill., Electric Light and Power Company, and the mammoth electric power house of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va. Some of their factory work was illustrated in a recent issue of the REVIEW.

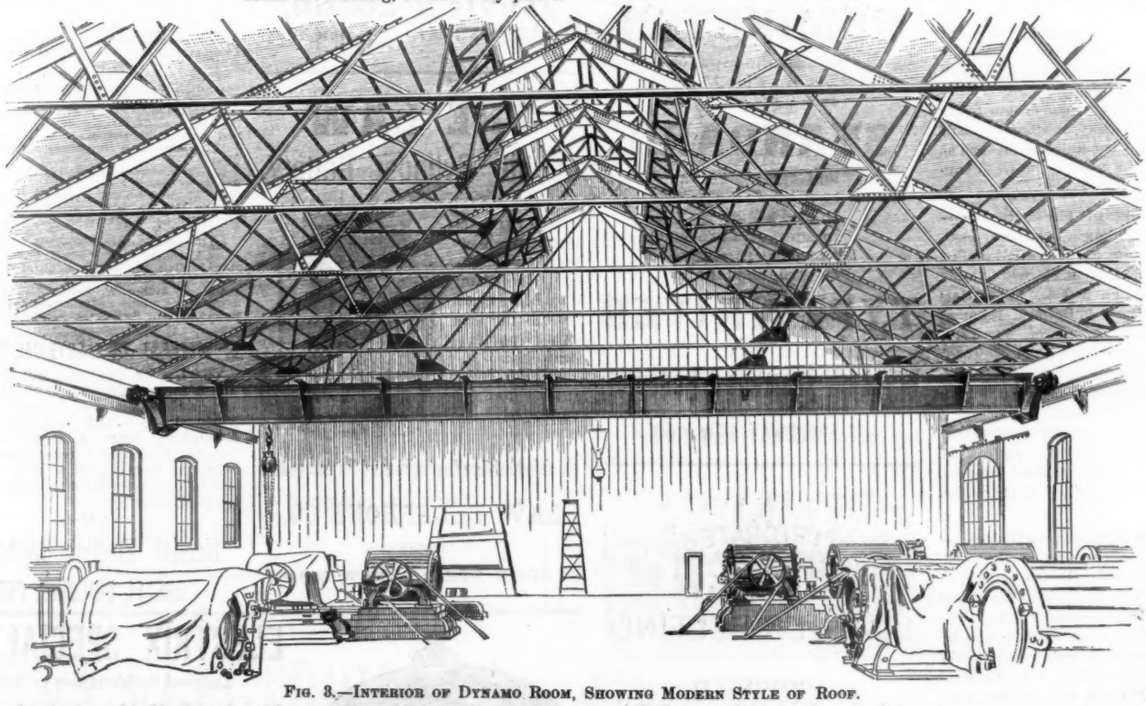

FIG. 3.—INTERIOR OF DYNAMO ROOM, SHOWING MODERN STYLE OF ROOF.

ELECTRIC CLUBS.

New York Electric Club.

Open house on New Year's day was greatly appreciated by about 100 members and their friends, who trudged cheerfully through the slushy streets to be present at the Club's annual fête. President Madden and others of the prominent members did the honors, and made every one welcome and comfortable. Electric Club punch was served and most favorably criticised by every imbiber. The Club's famous silver punch bowl was filled and re-filled many times during the day and evening. A delightful informal lunch was served by Steward Stadler in a tasteful manner.

The inclement weather doubtless prevented many from coming who would otherwise have paid their respects to the Club. As it was, the house was comfortably filled from noon till nearly midnight.

Among those who dropped in during the afternoon and evening were: Gen. O. E. Madden, Judge Leicester Holme, H. L. Storke, F. T. Boynton, J. W. Godfrey, H. Ward Leonard, W. J. Morrison, H. C. Adams, R. T. McDonald, J. J. Carty, T. L. Fowler, C. D. Shain, W. H. Fleming, E. F. Peck, H. L. Shippy, J. Welch, E. E. Bartlett, H. L. Lufkin, F. Z. Maguire, Frank Harrington, H. D. Stanley, H. D. Cheever, Dr. J. B. De Lery, P. H. Alexander, Gen. C. H. Barney, F. R. Colvin, J. A. Colby.

Mr. J. C. Chamberlain's familiar face was missed. He is away on a vacation trying to recuperate from his recent illness.

Recent out-of-town visitors were: S. F. Adams and W. L. Adams, Goshen, Va.; Lyman B. Goff, Pawtucket, R. I.; Robert C. Broadhurst, Philadelphia; H. B. Richardson, Amherst, Mass.; Bryson Burroughs, Cumminsville, O.; Richard D. Knight, Providence, R. I.; H. A. Darnall, Lock Haven, Pa.; Edw. Cannon and H. W. Shurtz, Portland, Ore.

Boston Electric Club.

The first quarterly meeting for the current year was held at the Club rooms, 7 Park street, Monday evening, January 5th. It was the first meeting under the new administration, and was largely attended.

* * At a meeting of the Spokane Falls, Wash., city council, last week, a franchise was granted to the Spokane Street Railway Company to operate and maintain an electric street car line. An ordinance was also passed which will prevent any street car franchise being sold without consent of the city council.

The public offices in Paris will be lighted by electricity.

KINDRED INTERESTS

The Hunt Engineering Company, Brooklyn, N. Y., on the 6th inst., removed their offices from 177 to 179 Montague street, to 238 Washington street.

Grimshaw White Core Wire is being used throughout the White House, now being wired for electric lights. This is a card for the New York Insulated Wire Company who make the brand mentioned.

The Electric Gas Lighting Company, 195 Devonshire street, Boston, is out bright and early with a new 1891 catalogue in a blue cover. A lot of new things, in addition to the company's old stand-bys, are priced and illustrated.

Merchant & Company, Philadelphia, dealers in metals, publish a circular called "A Tin Roof," telling how to buy, build and care for that important part of any house. They say that a good tin roof, aided by frequent ground connections, is sometimes a splendid lightning rod.

Messrs. W. R. Fleming & Company, 174 Fulton street, New York city, agents for the Harrisburg "Ide" and "Ideal" engines, have closed contract during the past week for complete steam plant for North Plainfield, N. J., 50 horse-power. The "Ideal" self-oiling engine to be used, and horizontal tubular boiler with Weitmeyer setting, patent furnace. They have also taken an order from the well-known firm of Ketcham & McDougal, of York and Washington streets, Brooklyn, for 50 horse-power "Ide" engine to run electric light plant which is to be installed by this concern.

Central Electric Company. — An unexpectedly large demand has arisen for the new Bain glass and break insulators recently illustrated in the REVIEW. The Central Electric Company has just received its first stock order of these articles, and report that every insulator was sold before the shipment arrived. These insulators have a very practical appearance, and construction men speak highly of them. Orders for Okonite and improved Candee wires continue to flow to the Central Electric Company, and these standard articles seem to have no dull season, such as is expected in other lines of electrical supplies.

The Commercial Electric Company, of Detroit, Mich., electrical engineers and contractors, have recently installed the following incandescent electric lighting plants: E. S. Fitch & Co., E. J. Hargraves & Son, Green & Bramen, Edmund Hall, Bousfiled & Co., all of Bay City, Mich.; P. L. Sherman & Co., of Linwood, Mich.; A. J. Doherty, of Clare, Mich.; Peninsular Car Company, of Detroit, Mich.; and are now fitting up the laboratory of Parke, Davis & Co., for 500 incandescent lights. Both the construction and supply departments are doing an excellent business, and the prospects for business next year are very favorable.

The Paiste China Switches. — H. T. Paiste, manufacturer of the well-known Paiste specialties, is now placing on the market a switch, the handle, cover and base made of English ivory china. The switches are very neat and artistic, and designed for fine residence installations. They are furnished in all colors, to match wall-paper and felts. Those with the dull gold finish are particularly fine. The demand for these goods has been so great that 500 are being imported weekly. One noticeable feature is that the cap screws on the base with a thread cut in the china. Mr. Paiste claims for these switches that they will always present a fine appearance, as the china cover will not tarnish, as all metal caps do in time, when exposed to atmospheric changes.

THE PAISTE CALENDAR FOR

1891

THE MANUFACTURER OF PAISTE ELECTRICAL SPECIALTIES TRIED TO REMEMBER ALL WHO ARE INTERESTED IN ELECTRICAL WORK, AND SENT THEM A FINE ENGRAVED CALENDAR FOR 1891, ON THE BACK OF WHICH ARE PRINTED ILLUSTRATED POINTERS ABOUT THEIR SPECIALTIES—A HANDY THING TO HAVE IN YOUR OFFICE. IF YOURS DID NOT ARRIVE SEND POSTAL AND YOU WILL RECEIVE ONE.

H. T. PAISTE,

1201 MARKET STREET, PHILADELPHIA, PA.

THE PAISTE SPECIALTIES.

SWITCHES, CUT-OUTS, SOCKETS,

KEPT IN STOCK AND FOR SALE BY ALL PROMINENT SUPPLY HOUSES.

The Armington & Sims Engine Company report about the same story as told a year ago, says the Providence *Journal* —a constant, steady increase of business. There has been no time during the past year when they have not had a very large number of orders booked, and the amount of business done shows an increase of fully 33⅓ per cent. over 1889. As the demand increases they have gradually increased their plant and facilities, until they now have the largest and best equipped concern in the world for their especial line of work. They have a large amount of work in progress, not only for their Standard high-speed engines, but also special engines of large sizes for electric power stations and large triple compound engines for rolling mills. The outlook for the coming year is favorable for a vary large business.

THE REMINGTON

has set the copy for writing machines for 15 years. It is to-day the

STANDARD

and expects in the future, as it has in the past, to lead all others in adding improvements to what will always be the true model of a

TYPEWRITER

Wyckoff, Seamans & Benedict,

327 BROADWAY, NEW YORK.

PATENT PERFORATED ELECTRIC LEATHER BELTING

MANUFACTURED BY

Charles A. Schieren & Co.,

45, 47, 49, 51 FERRY ST., COR. CLIFF ST.

BRANCHES:

BOSTON, 119 HIGH STREET.
PHILADELPHIA, 226 NORTH 3d STREET.
CHICAGO, 46 SOUTH CANAL STREET.

Address, for Circular of Styles and Prices,

JARVIS B. EDSON,

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THE LAW

Double Cylinder Battery.

Surface of negative element and quantity of solution double that found in any other open circuit cell. Weigh carefully these advantages.

Its sale has steadily increased for ten years.

LAW TELEPHONE CO.,

Sole Makers,

87 JOHN STREET, NEW YORK.

ELECTRIX SWITCH.

ELECTRIX SPECIALTIES.

Endorsed the World over by Users.

Simple. Reliable. Indestructible.

DEALERS REPORT QUICK SALES.

CORRESPONDENCE INVITED.

THE STAR ELECTRIX CO.,

1320 Wallace St., Philadelphia, Pa.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON DECEMBER 30, 1890.

443,493 443,494 Telephone; Sigmund Bergmann, New York, N. Y., assignor to Edw. H. Johnson, same place.
443,497 443,565 High resistance compound; Wm. G. Bremer, St. Louis, Mo., assignor to the United Electric Improvement Co., Gloucester City, N. J.
443,505 Telegraph blank; John O. Donnell, Lowville, N. Y.
443,507 Phonograph; Thos. A. Edison, Llewellyn Park, N. J.
443,508 Pole top for trolley wire supports; Wm. L. R. Emmet, East Rockaway, N. Y.
443,526 Telephone; Edw. H. Johnson, New York, N. Y.
443,527 Apparatus for automatically grounding or cutting out of circuit exposed electrical conductors; Francis W. Jones, New York, N. Y.
443,530 Socket for electric lamps; Chas. A. Lieb, New York, N. Y.
443,536 Art and means for covering and insulating wire; Thos. W. Norman, Boston, Mass.
443,543 Key turner for gas and electric lights; Lewis H. Rockafellow, Philadelphia, Pa.
443,551 Machine for covering electrical conductors with lead; Francis H. Stillman, New York, N. Y., assignor to James B. Atherton, same place.
443,556 Secondary battery; Harry H. Wardwell, Lake Village, N. H.
443,557 Arc lamp; Alonzo W. Whitcomb, Worcester, Mass.
443,562 Incandescent lamp socket. 443,563 Shade holder for incandescent lamps; Sigmund Bergmann, New York, N. Y.
443,580 Electrical and vapor face bath; Nathaniel Lyke, Williamsport, Pa.
443,598 Apparatus for preventing steam boiler incrustation; John Langstaffe, Battersea, England, Story B. Ladd, administrator to said Langstaffe, deceased.
443,606 Switch; Edw. H. Johnson, New York, N. Y., assignor to Bergmann & Co., same place.
443,632 443,633 Electric arc lamp; Edw. Heymann and Frank W. Heymann, Boston, Mass.
443,636 Apparatus for measuring and registering electric currents; Camille A. Faure, New York, N. Y., assignor to Edw. C. Davidson, same place.
443,643 Electric meter; Chaimsonovitz P. 'Elieson, London, England.
443,646 Magneto-electric stop mechanism; Washington H. Kilbourn, Greenfield, Mass., assignor to Herbert O. Edgerton, same place.
443,661 443,677 Traction and brake device for electric railways; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Co. of America, same place.
443,671 Electric locomotive; Rudolph Eickemeyer, Yonkers, N. Y.
443,674 Electric stop motion for warping machines; Philipp Goldschmidt, Paterson, N. J.
443,693 Electric switch; James J. Wood, Brooklyn, N. Y.
443,716 Electric damper regulator; Jeremiah O'Meara, New York, N. Y.
443,724 Electric fire alarm and extinguishing system; Chas. E. Ongley, New York, N. Y., assignor of one-half to Thos. W. Robertson, same place.
443,725 Non-interfering signaling system. 443,726 Electrical signal system. 443,727 Safety device for dynamo stations; Chas. E. Ongley, New York, N. Y.
443,746 Electric lamp socket; John T. Dempster, Summit, N. J., assignor to Bergmann & Co., New York, N. Y.
443,748 Method of electric soldering and cementing cans. 443,749 Apparatus for electric soldering and cementing cans; Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place.
443,772 Electro-magnetic clutch; Chas. E. Kells, Jr., New Orleans, La.
443,787 Watchman's electric time recorder. 443,789 Electric valve-controler. 443,790 Electric protective and signaling system; Chas. E. Ongley, Yonkers, N. Y.
443,788 Watchman's electric time recorder; Chas. E. Ongley, New York, N. Y., assignor of one-third to Thos. W. Robertson, same place.
443,814 Electrical attachment for railway switches; Arthur W. Berne, New Orleans, La., assignor, by mesne assignments, to the Electrical Safety Railway Switch Co., Limited, same place.

OF INTEREST TO ELECTRICAL ENGINEERS.

The Heisler Electric Light Company desire to correspond with electrical engineers or first-class electrical enterprises in New York, Massachusetts, Connecticut, New Hampshire, Vermont, Upper and Lower Canada, Northwest Territory and all of the Southern States with a view of entering into an arrangement for them to act as agents for the Heisler System.

Address,

Heisler Electric Light Co.,

DREXEL BUILDING, PHILA.

RAILWAY FEEDER-WIRES.

Experience has demonstrated the necessity for the ***Best Insulation*** on Feeder-Wires.

THE BEST IS NOT TOO GOOD

—THE—

SIMPLEX

—IS THE—

BEST

WITNESS THE FOLLOWING:

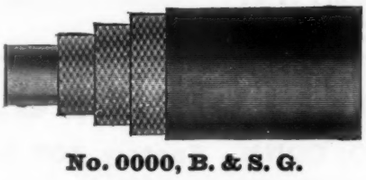
WEST END STREET RAILWAY CO.,
BOSTON, MASS., March 13, 1890.

SIMPLEX ELECTRICAL CO., Boston, Mass.:

Gentlemen: In regard to your inquiry concerning my opinion of the Simplex Wires, I would say that during the last year we have used a great many miles of the larger sizes, principally the **0000,** and it has given excellent satisfaction. There has been no case, to my knowledge, of trouble arising from these wires.

The general appearance and workmanship of the wire are first-class, and I consider it equal to any wire, and superior to most wires, for overhead work. Yours truly,

F. S. PEARSON,
Chief Engineer Steam and Elect. Dept.



No. 0000, B. & S. G.

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ELECTRIC LIGHT WIRE,

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CARDEW VOLTMETERS.

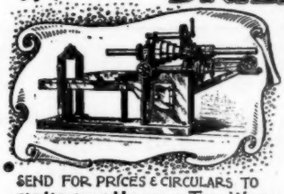
These are the only standard Voltmeters that can be used on *ALTERNATING* as well as *DIRECT CIRCUITS.*

DIRECT READING. DEAD BEAT.
CAN BE LEFT IN CIRCUIT CONTINUOUSLY.

Send for Catalogue 1-66 of Electrical Test Instruments.

QUEEN & CO., PHILADELPHIA.

Horizontal DRILLING AND BORING MACHINE



Great Power.
WIDE RANGE OF
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SEND FOR PRICES & CIRCULARS TO
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THE LECLANCHÉ BATTERY CO.,
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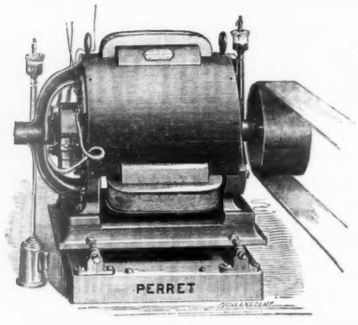
MANUFACTURERS OF



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LAMINATED FIELD MAGNETS, HIGH EFFICIENCY,
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Motors of any size for any purpose. Factories equipped throughout with Electric Power.
Isolated Plants for Incandescent Electric Lighting.

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ST. PAUL, MINN., F. J. Renz, 327 Minnesota St.
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Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity. Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

PATENT "K. K." LINE WIRE

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For Electric Light, Electric Railways, Motors, Telegraph and Telephone Use.

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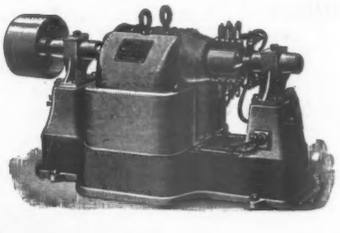
Do You Want { The Best Goods / Good Prices / PROMPT SHIPMENTS } ?

IF YOU DO, WRITE US FOR QUOTATIONS.

AGENTS FOR THE CONNECTICUT MOTORS.



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THE PERKINS ELECTRIC SWITCH MFG. CO.

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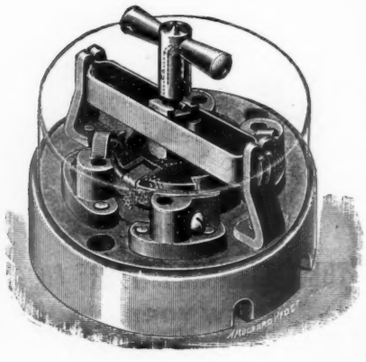
THE PERKINS INCANDESCENT SWITCHES.

Made with Porcelain Bases only.



No. 1.	Capacity up to	10	Amperes,	Single	Pole.		
No. 2.	"	"	"	15	"	Double	Pole.
No. 3.	"	"	"	30	"	"	"
No. 4.	"	"	"	40	"	"	"
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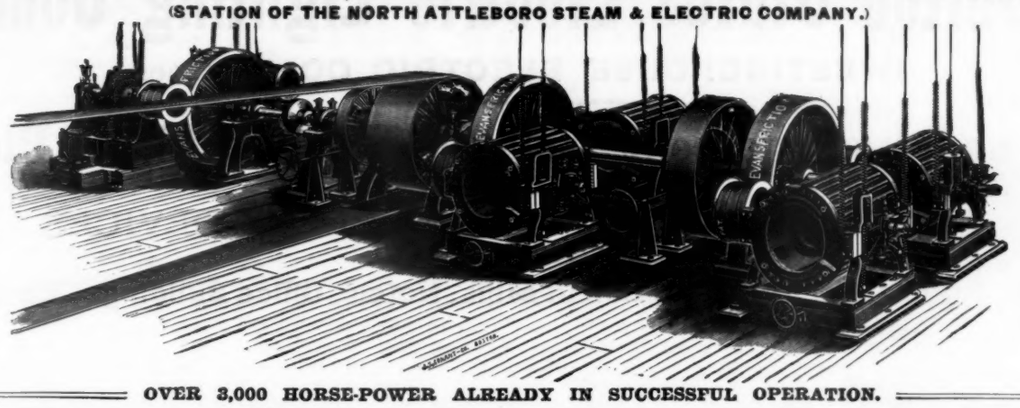

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C	8	.....	.....	.....	6.5	1¼	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.3	1⅜		530
C	.....	.....	.....	25	8.0	2		530
M	16	.....	.....	.....	12.0	2½		780
M	.....	20	.....	.....	12.5	2½		780
M	.....	.....	26	.....	13.0	2¾		780
M	20	.....	.....	.....	15.0	3		990
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G	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
G	.....	.....	45	.....	21.0	4		1,360
G	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
H	.....	.....	64	.....	29.5	6		1,750
I	52	.....	.....	.....	38.0	8		2,290
I	.....	65	.....	.....	38.6	8		2,290
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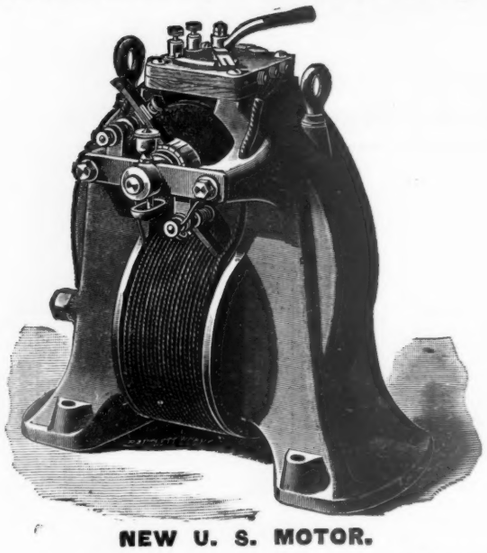

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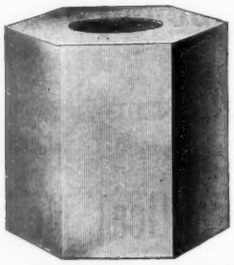

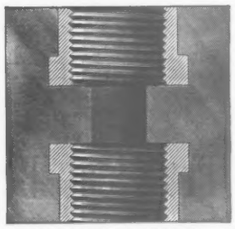

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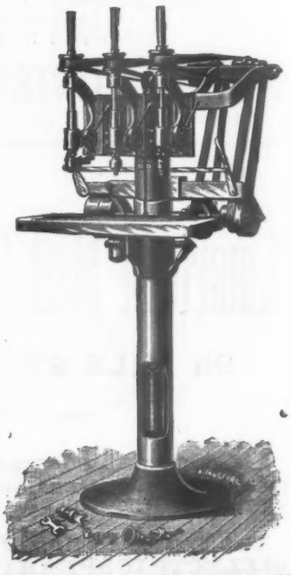

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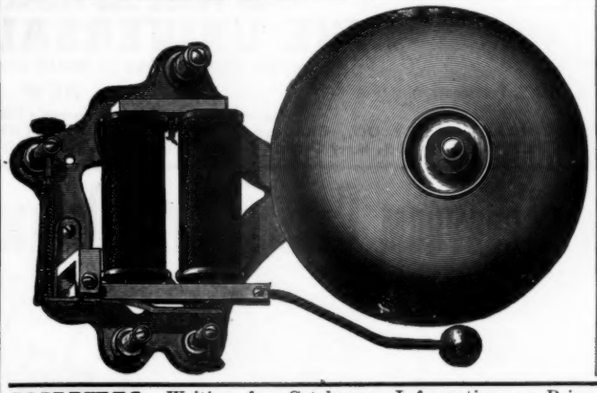

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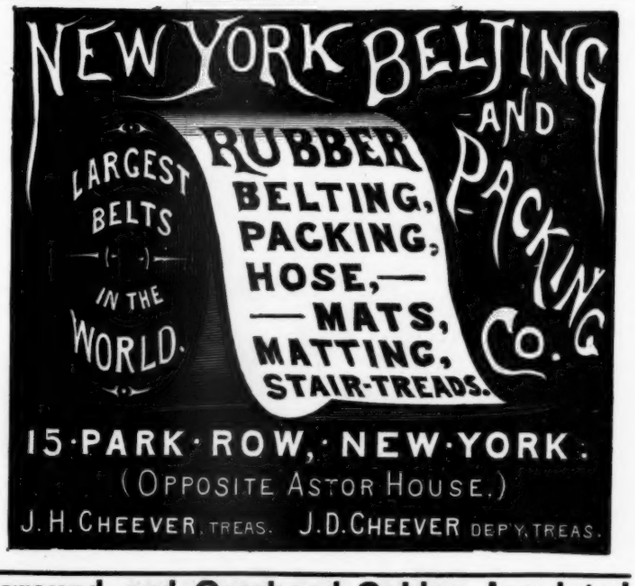
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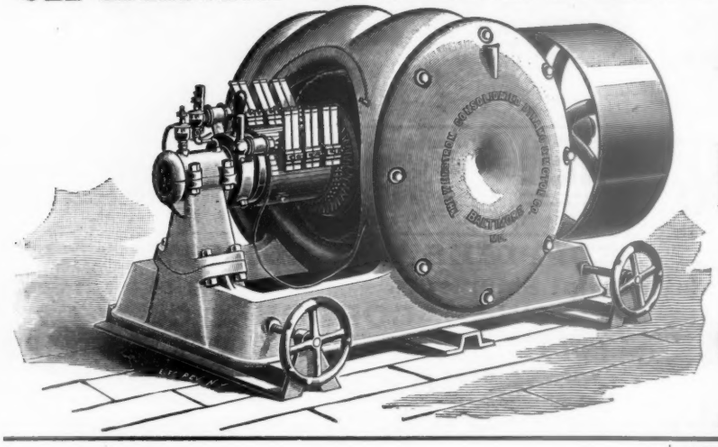

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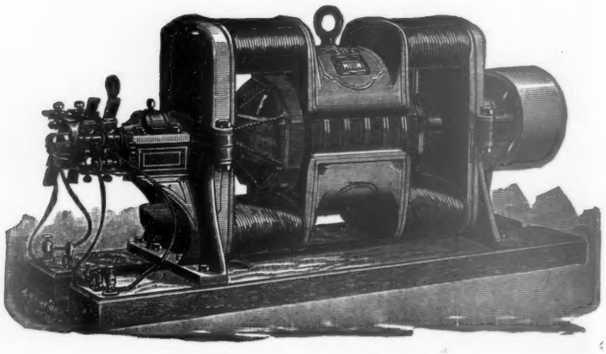

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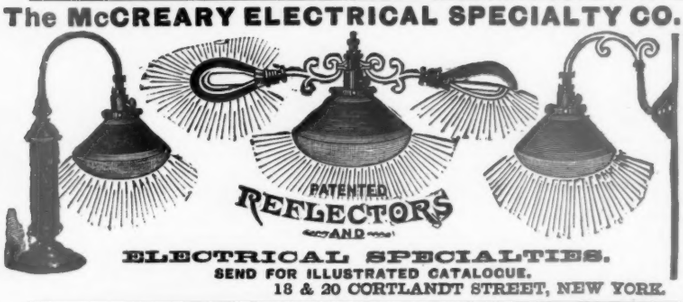

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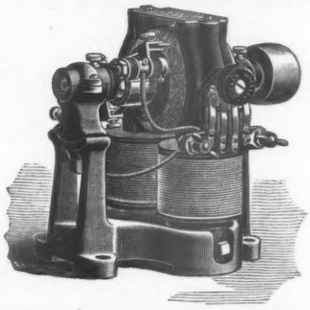

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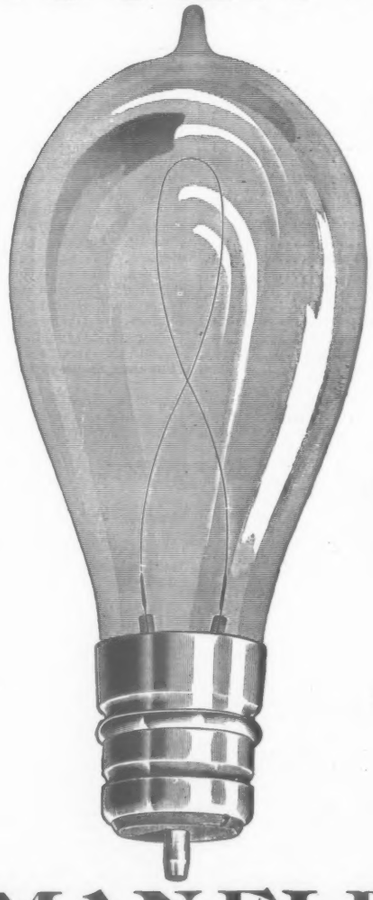

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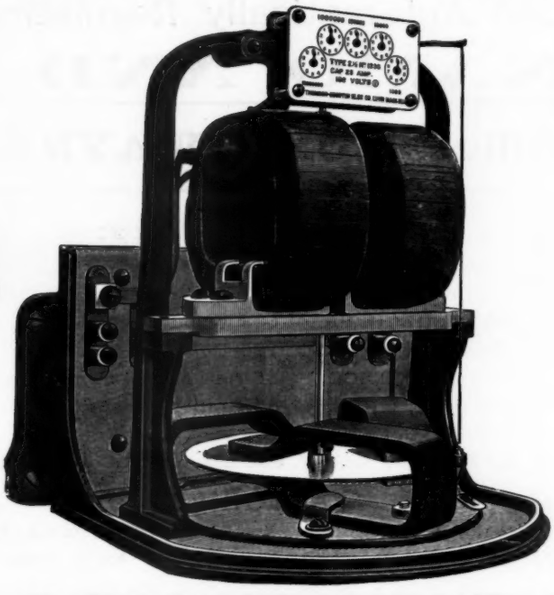

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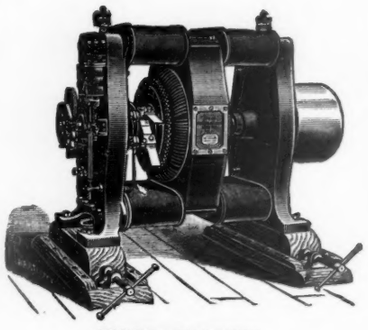

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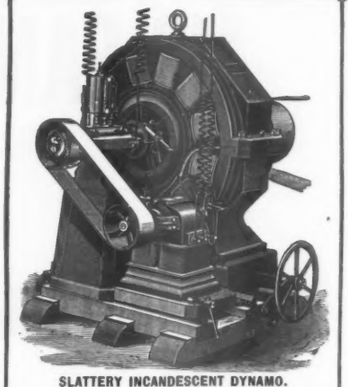

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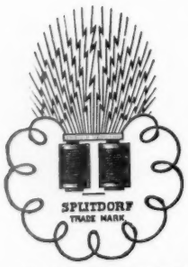

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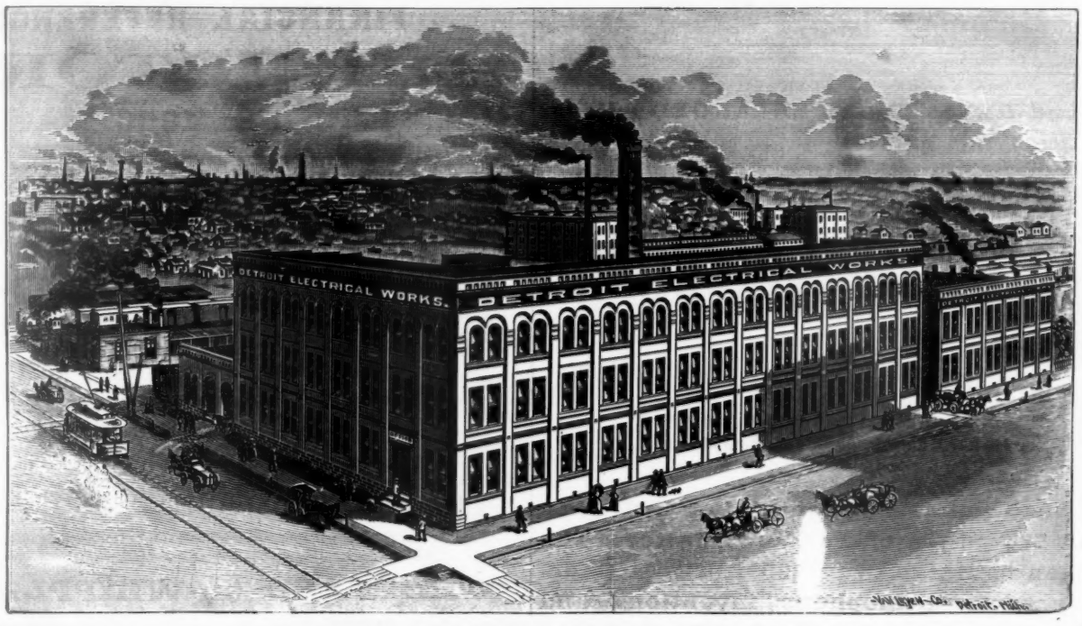

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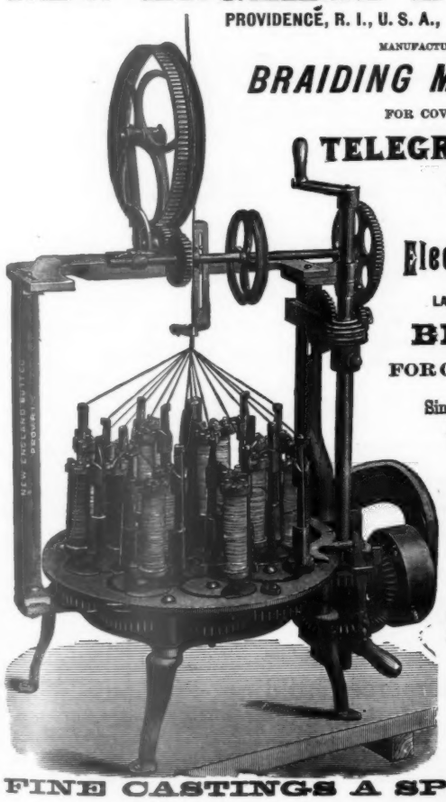

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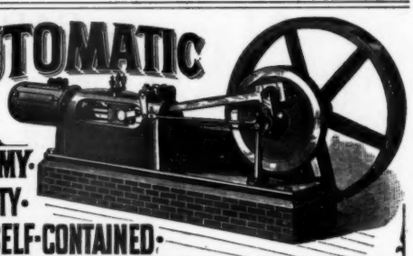

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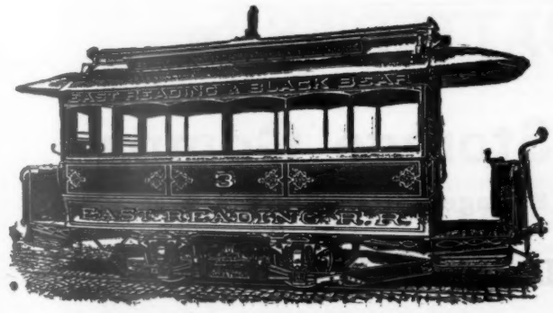

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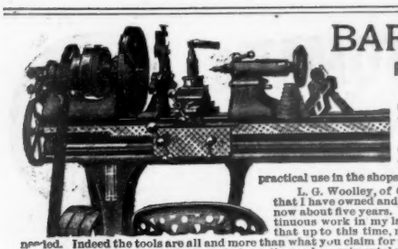

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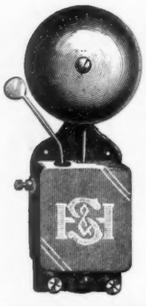

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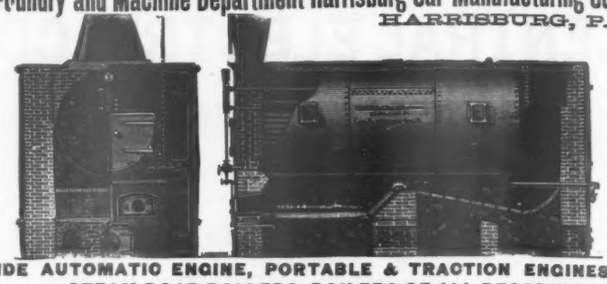

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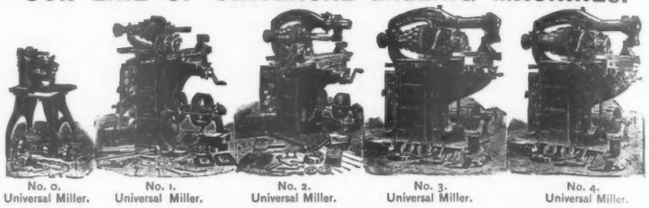

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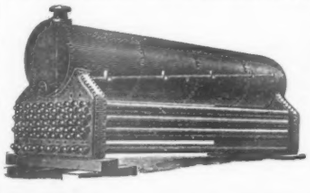

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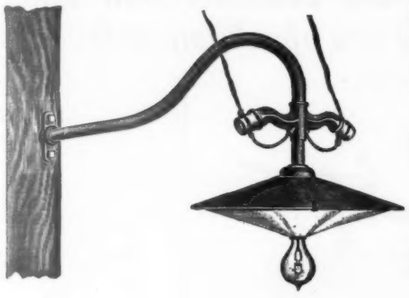

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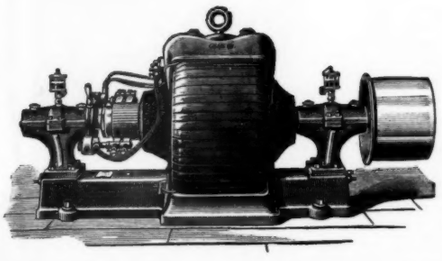

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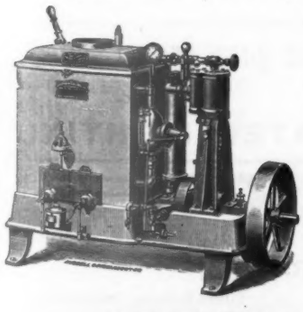

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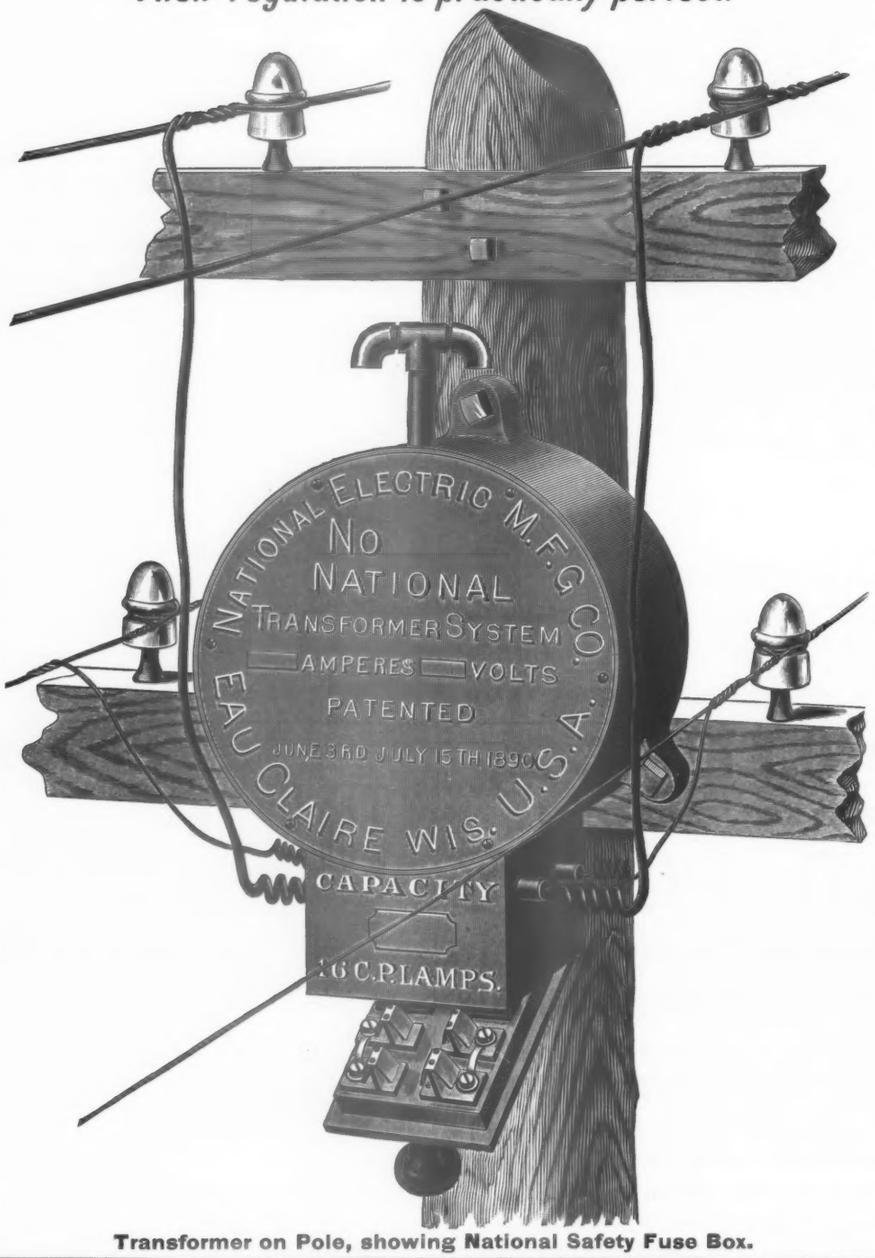

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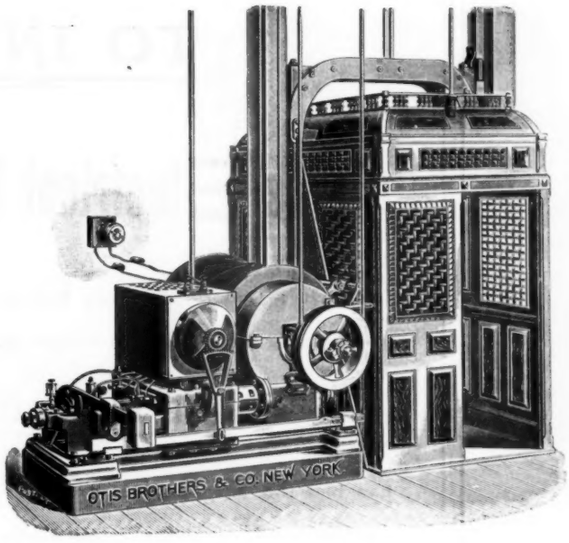

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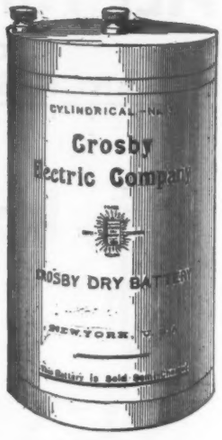

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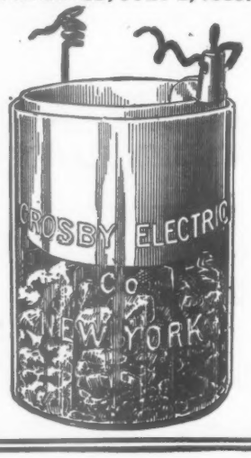

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